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SURGERY OF THE FACE, MOUTH AND JAWS, THIRTY YEARS AGO AND NOW

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THE object of this paper is to take stock, so to speak, of the progress, if any, that has been made in the field of oral and plastic surgery, since I began to practice the specialty thirty-three years ago. I do not want to give any one the impression that I think the acme of perfection has been reached—far from it. There is tremendous room for improvement in many directions and always will be, and no doubt thirty years hence our younger men just now starting will look upon the present leaders as mere tyros. But I hope they will recognize, as we of the present do of those who have gone before, that we are doing the best possible in the light of present knowledge. We owe a heavy debt to our great predecessors—Hullihen, Garretson, Kingsley, John Sayre Marshall, Brophy, Gilmer and Cryer, to mention only a few. Without their work as a foundation, much of our present progress would have been impossible.

Perusal of the literature and recollection of practice a third of a century ago in comparison with that of the present day will reveal much of interest. I will cite a few examples. In many instances, the fundamental pathologic facts regarding a disease were well understood at that time, and most of the progress has been made in diagnosis and treatment. For example, examination of the 1909 edition of John Sayre Marshall's "Injuries and Surgical Diseases of the Face, Mouth and Jaws" shows that the cause and symptoms of erysipelas, a streptococcic cellulitis of the skin, frequently affecting the face, were well understood. Under treatment, he states that "the value of specifics, either in local or in constitutional treatment, is to be seriously

questioned, for what has seemed in one case to be successful has in another proved a signal failure." Treatment in those days consisted largely in local applications of germicidal solutions to restrict the spread of infection; the use of remedies locally to relieve the itching and burning sensation, and constitutional treatment, such as internal administration of tincture of ferric chloride, quinine, Dover's powder and stimulants. Compare this to the present treatment with specific serum, roentgenotherapy and, latterly, the administration of sulfonamide drugs, measures by which the disease is controlled almost immediately.

In surgical shock and hemorrhage, we have seen in recent years the great benefit resulting from infusion of blood plasma and whole blood transfusion. Other physiologic means of combating unfavorable nutritional body states, such as the intravenous administration of solutions of glucose in acidosis, have contributed greatly to the safety of operations formerly attended by grave risk.

We have only to read what Marshall has to say of the cause of syphilis to realize the immense progress that has been made since his time in the diagnosis and treatment of this disease. He says: "The clinical features of the disease make its microbic origin almost certain, and that the organism is a *bacillus,* but it has not been satisfactorily demonstrated." This statement was a little out of date, for *Treponema pallidum* was discovered by Schaudinn in 1905, and the complement fixation test for syphilis by Wassermann a year later. I well remember seeing the first Wassermann tests being made in Philadelphia in 1909, and I began making them myself in 1911. In 1910, Ehrlich brought out his famous "606," or arsphenamine, which revolutionized the treatment of syphilis.

Among the greatest advances that have been made in our special field are those in connection with anesthesia, both local and general. When novocain was first introduced in this country, about 1911, there was great prejudice on the part of some of the older men against the use of local anesthetics for the extraction of teeth owing to the known dangers of cocaine when injected with a syringe. When I began as a young assistant in oral surgery at the University of Pennsylvania Dental School, I had to keep the novocain syringe hidden from my superiors for fear of dismissal. Nerve blocking and infiltration with novocain (procaine) have made possible operations in office practice that thirty years ago could have been done, if at all, only under a general anesthetic in a hospital. This ease of administration has, in a few instances, caused overambitious practitioners to attempt operations for which they are unqualified, but, as a general thing, the benefits far outweigh the disadvantages.

The older ones among us well remember the inconvenience of operating about the mouth and jaws under general anesthesia thirty years ago. The ether mask had to be removed while the operation was begun, then the operation had to be interrupted so that more ether could be given. Owing

to the lack of suction apparatus, the throat had to be continually swabbed with gauze sponges to remove blood and mucus, and postanesthetic respiratory complications were common. With modern facilities, it is a pleasure to operate under general anesthesia, which proceeds smoothly and uninterruptedly while the operation is going on, the anesthetic being introduced through intranasal or intra-oral tubes, or, better still, through an intra-oral or intranasal tube carried into the trachea. We have skilful anesthetists to whom the passage of a tube through the nose into the trachea is almost as simple as starting an automobile. Mucus and blood in the throat are easily taken care of by means of the suction apparatus, without interruption of the operation. Other methods of anesthesia, preferred by some surgeons, which render unnecessary any apparatus about the face are rectal, by means of tribromethyl alcohol, and intravenous, by evipal, a thiobarbiturate or similar agents. Thus, today, we have at our command a wide choice of anesthetic methods, local and general, to suit the needs of the individual case, whereas thirty years ago, for most cases, we had to struggle with the nitrous oxide inhaler or the open-drop ether mask.

It is quite unnecessary to point out the great changes for the better that have come about through the development of the x-rays for diagnosis of conditions in this special field. I well remember, when the x-rays were just coming into use, how M. H. Cryer used to say that for diagnosis of the position of an impacted third molar, he much preferred a good sharp dental excavator. However, as better technical pictures began to appear, he was one of the first to acknowledge their value, and he made many contributions to the literature based on cases in which the x-rays played an important part in diagnosis.

While the principles of treatment of fracture of the jaws were well understood thirty years ago, and fixation by apparatus applied to the teeth resulted in successful restoration of occlusion, there have gradually been developed simplified methods of fixation by means of wire ligatures and arches which require less technical work and which assure more rapid results with greater comfort to the patient. At present, direct skeletal fixation of fragments by metal pins attached to an external bar is a valuable adjunct when the time-honored methods are not applicable. Tremendous improvement has occurred in the treatment of complications of these bone injuries, such as mal-union and non-union, with or without loss of substance. Bone grafting was then regarded as a surgical curiosity. Marshall mentions the possibility of bone grafting from human beings and the lower animals in the treatment of non-union of fractures. He reported before the Ninth International Medical Congress a partially successful case of bone grafting of the lower jaw of a woman, to fill a gap 1½ inches in length. The operation was performed in 1887, by grafting twelve small pieces of bone taken from the lower epiphysis of the femur of a young rabbit. Union took place with the ramus, but not the anterior fragment of the bone, a gap of

half an inch remaining to be filled. A second operation failed from necrosis and further attempts were abandoned. Such early efforts encouraged those who followed, until, with numerous cases of large gaps in the mandible resulting from injuries in World War I, success crowned these efforts, and today the restoration of large defects in the mandible is almost commonplace. This has come about through improved surgical technic and recognition of the fact that the patient's own tissues form the only favorable material for grafting. While most of the principles of plastic surgery were well known a hundred years ago, World War I provided a wealth of material permitting the development of methods of utilization of larger transplants of tissue taken from distant parts of the body. Space will not permit credit to be given here to all those whose contributions are landmarks in the general progress. If history runs true to form, the present war will signal advances in methods of treatment of injuries and the correction of deformities. This has already been manifest in the prevention and treatment of shock and wound infection, and new developments in the management of fractures.

In congenital deformities also, such as cleft lip and palate, there has been considerable improvement in our methods of treatment. Truman W. Brophy, who was in his prime thirty years ago, was one of the first to recognize the importance of early operation in these cases. Since Brophy's time, distinct improvements have been made in the cosmetic results of the cleft lip operation, and also in the formation of a more flexible and adequate soft palate, with consequent improved speech.

In the treatment of malignant tumor of the mouth and jaws, immeasurable advances have been made, especially through the development of radiation therapy and electrothermic surgery. The extensive and mutilating resection operations have been largely abandoned, and by the judicious combined use of the agents mentioned, cases hitherto regarded as certainly hopeless have occasionally been cured. While there is still much to be desired in the management of cancer, the results of modern methods of treatment are decidedly encouraging.

Preparation of the dentist for the practice of his profession has kept in step with these advances. Thirty years ago, dental students had almost no instruction in general pathology or in the part played by the mouth and teeth in their relation to health and disease of the body as a whole. They knew nothing of blood counts, urinalysis, culture methods and other procedures that are now regarded as a fundamental part of their training. The work of Billings, Rosenow, Gilmer and others in connection with dental infection and systemic disease, together with the development of the x-rays in dental diagnosis thirty years ago, was really the start of this tremendous broadening of dentistry as a specialty of the healing art rather than a largely technical craft localized in the mouth. In the best dental schools of today, there are complete courses in general pathology, and

instruction in clinical medicine is given in the hospital, through which the dental student is made familiar with disease in general. Thirty-five years ago, dental internships in hospitals were virtually unheard of. In 1901, Dr. Cryer organized an oral surgical department at the Philadelphia General Hospital with a visiting staff of four, and two dental interns, of whom I was one. So far as I know, there were no others anywhere in the United States at that time. Since then, the Philadelphia General Hospital has continuously had a dental intern service, and today there is scarcely a large hospital in the country that is without such a service. I believe the time is coming when hospital internship will be a requirement for the practice of dentistry, just as it is now in most states for the practice of medicine.

1930 Chestnut Street.

The Things That Make Surgery Safe.—Surgery will never be as safe as it should be until we return to first principles, until we insist that no man shall be permitted to practice it unless he is possessed, unless he proves himself to be possessed, of at least four things, a natural aptitude, adequate knowledge, sound judgment, and that quality which, for lack of a better name, we call the surgical conscience. I am far from believing that good surgeons cannot be moulded out of most unpromising clay, for I have seen the miracle happen many times, but I have never seen a man become a good surgeon who did not have at least some natural aptitude. I have never seen a man, whatever his other qualifications, become a good surgeon who did not like to do things with his hands, who did not know how to use his hands swiftly, gently and surely. We are fond of saying, and we are quite correct in saying, that there is more to the practice of surgery than mere craftsmanship. But let us not forget the tremendous importance of craftsmanship. The surgeon must do his work swiftly and accurately, he must, in his actual performance, as Lord Moynihan says, make of surgery a merciful art. The fact that under anesthesia operations can be done deliberately today must not be construed to mean that time is of no consequence. Time is of the greatest consequence. An operation that is unduly prolonged increases the patient's risk and is usually a very clear indication that the surgeon who is doing it frankly does not know the mechanical part of his task. . . . The tissues of the human body can be insulted up to a certain point; after that point the retribution is swift and sure, and the surgeon who does not know how to be dexterous will do well to remember that fact.—C. Jeff Miller, in *Am. J. Surg.*, 1931.

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OSTEOFIBROMA OF THE MANDIBLE ASSOCIATED WITH LEONTIASIS OSSEA OF THE SKULL: REPORT OF A CASE

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THERE are certain jaw lesions that still require additional study for recognition, classification and treatment. Among these is a lesion that has more recently and properly been termed the osteofibroma. This term has been used in the literature synonymously with localized osteitis fibrosa, fibroma, localized Paget's disease, fibro-osteoma and fibrous osteoma. Many of these terms, apparently, have arisen from the varying histopathologic structure with reference to the fibrous and osseous tissue revealed by the microscopic examination.

Kurt H. Thoma gives a logical explanation for accepting the term fibro-osteoma as suggested by Furedi in preference to the older term of localized osteitis fibrosa because it appears well based on histopathologic findings. Classifications of lesions based on histopathologic structure appear appropriate, but the predominant tissue structure noted at different stages of the microscopic examination of the same lesion may alter the accepted term for this group of lesions.

With respect to the group of lesions termed osteofibroma, the predominant opinion is that the marrow spaces of the bone show a fibrous proliferation resulting in new bone. The process continues to show resorption of the old bone, thus establishing a cycle with the transformation of the bone marrow into new bone and breaking down of the old bone. The time of discovery and microscopic examination of this lesion have a bearing on the variation of the histopathologic picture. It is apparent that the fibrous tissue may be in abundance at one time, while the osseous issue may predominate during another period of tissue change. Round-cell infiltration, giant-cell formation and other inflammatory changes are absent. No malignancy has been known to result from these lesions.

The clinical picture of this group of lesions is one of a benign, painless, slow growing hard tumor mass, diffuse in outline and involving either jaw at various ages. Many lesions have been reported between 8 and 32 years of age. Owing to the lack of a definite line of demarcation of this lesion, the complete surgical excision is difficult, and, consequently, recurrence of this tissue change persists, following attempted enucleation. The patient shows no general debilitating effect and no glandular involvement unless secondary infection has been precipitated. However, the subjects of this disease do show a constitutional nervous makeup, and, for this reason, a

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possible disturbance in the calcium and phosphorus metabolism may be anticipated, but, as a rule, is not discovered in association with these lesions.

The roentgenogram reveals these tumor masses varying in areas of bone rarefaction and increased density. The central areas show a radiolucency frequently due to resorption of the central cancellous bone. The x-ray

Fig. 1.—Appearance of patient; showing right frontal enlargement with increase of distance between eyes.

picture varies with the period of growth and, along with the microscopic examination, influences the classification of this group of lesions.

The belief regarding the cause of these bone masses tends to lean toward trauma and infection. Caries and infection of the teeth are frequently ob-

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served in association with these lesions. Injury without bone fracture is a potential cause. Yet the absence of leukocytic infiltration of these areas, except in secondary complications, seems to eliminate the presence of bacteria as a cause. These tumors were said to show relationship to osteitis fibrosa, or Recklinghausen's disease, but no abnormalities in the blood calcium and phosphorus or in the remaining skeleton were found. The symptoms suggest little or no relation to osteitis deformans, or Paget's disease. One may assume that the cause is as yet undetermined. Certain authors still are of the belief that this condition is not an entity.

Another group of bone lesions involving the cranium and facial skeleton, but separate from the osteofibroma group, is known as leontiasis ossea. Virchow suggested this term to cover tissue thickening including the soft

Fig. 2.—Left, two photographs of right side of face placed together; showing frontal and temporal enlargement. Right, two photographs of left side of face placed together; showing lack of frontal enlargement. (Suggested by G. T. Pack.)

structures. The present term leontiasis ossea is applied to a tissue change affecting the bones of the face and skull, which undergo a varying diffuse hyperostosis with an associated thickening and sclerosing of its many bone sections. This condition is known to start early in life, but has also been noted in adults.

There is a great difference of opinion in regard to the classification and pathogenesis of these tissue changes known as leontiasis ossea. Many pathologists associate the condition with the localized form of osteitis de-

formans, or Paget's disease. Thoma mentions the fact that a definite classification of such a specific group of lesions is difficult because biopsies are performed in so few of these cases. It is apparent that, in the past, this term has been used vaguely to include any facial deformity or enlargement. Thoma was able to demonstrate that a periosteal new formation and a sclerosis of the bone spongiosa resulting from an overactivity of the osteoblasts produced the bone enlargement.

The x-ray findings in leontiasis ossea are important because of the lack of biopsies. The roentgenogram reveals the thickening and the increase in density of the bones involved. The lack of the "cotton-wool" appearance distinguishes this condition from Paget's disease. The clinical symptoms confirm the x-ray findings of a prominence and thickening of the involved bones of the face and skull. The orbits may be involved and the eyes may be pushed apart by the thickening of the bridge of the nose. The affection may spread to involve the frontal and parietal bone, and on into the sphenoid and temporal bones.

Fig. 3.—Right side of mandible; showing original partly decalcified area.

It is believed that few persons affected with this condition live beyond 30 years of age. Deep irradiation has been tried, but, to date, no specific treatment has been found satisfactory.

The case report below is of particular interest because symptoms of both osteofibroma of the mandible and leontiasis ossea of the skull are apparent. The patient's cooperation has also afforded complete progress notes, which are invaluable for a comparative study and report.

REPORT OF CASE

History.—Mrs. J. B., a white woman, slender, aged 32 years, came in August 1, 1939, with the complaint of a peculiar feeling of fulness in the lower right jaw. This feeling, which was of several months' duration, was not a sharp pain or discomfort, but merely a sense of pressure within the jaw bone. Although it was not troublesome, she was now more conscious of this jaw sensation, but was able to carry on her profession of teaching without interruption.

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The family history was essentially negative. The patient had had scarlet fever as a child. She had been treated for anemia six years before the present consultation and, three years later, for pains in the legs, with reddish blue lumps, diagnosed as erythema nodosum. Six months later, she had been treated for a "nervous breakdown," a condition of interest because it has been associated with typical jaw lesions in this report.

Examination.—Extra-orally, the right mandible showed a buccal and cortical fulness extending from the lateral incisor to the first molar area. Palpation revealed a hard non-fluctuating mass showing slight tenderness on pressure. The

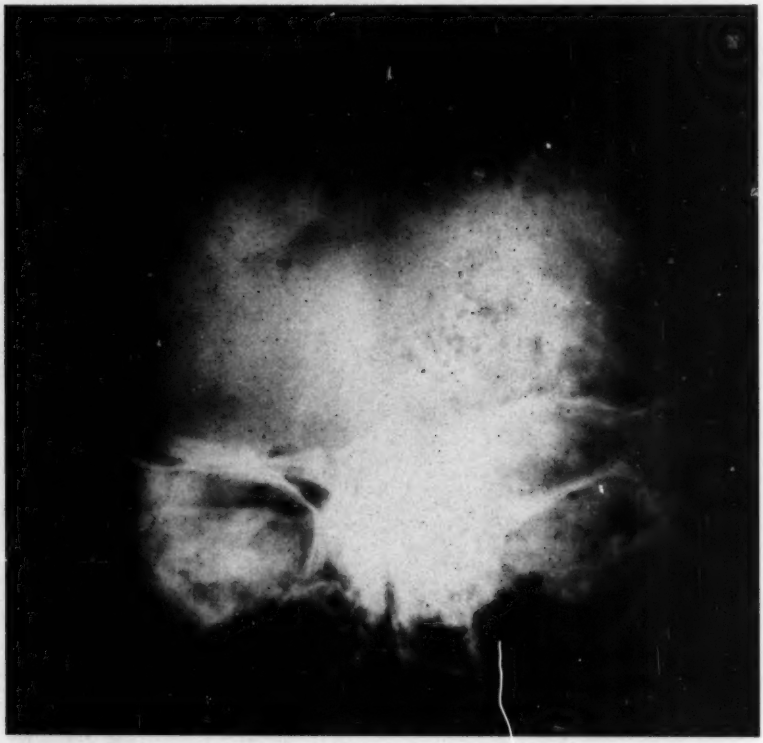

Fig. 4.—Postero-anterior view of skull giving evidence of lesion in orbital, frontal and parietal regions.

submaxillary, sublingual and submental glands were not indurated or palpable. There was unusual fulness and prominence involving the right frontal and temporal bones. The bridge of the nose showed a moderate thickening with a marked increase in the distance between the eyes. (Fig. 1.) The right frontal and temporal areas were considerably enlarged. Figure 2, left, was made by placing together two photographs of the right side of the face; Figure 2, right,

by placing together two photographs of the left side of the face. In this way, the enlargement is clearly emphasized.

Intra-oral examinations revealed good oral care. There were no signs of acute inflammation or fistula evident. Palpation revealed fulness of the alveolar ridge buccally in the right bicuspid molar area, with no lingual prominence present. Palpation elicited a slight tenderness over the alveolar prominence.

Laboratory report: The blood Wassermann reaction was negative. A phosphatase test showed: inorganic phosphorus: 2.4 mg. per hundred cubic centimeters of blood; total phosphorus: 4.04 mg. per hundred cubic centimeters of blood; phosphatase: 1.64 units (Bodansky) per hundred cubic centimeters of blood.

Fig. 5.—Lateral view of skull showing increased density of temporal and frontal areas.

The blood calcium report was as follows: blood calcium: 14.3 mg. per hundred cubic centimeters of serum; normal findings as to phosphorus and phosphatase, with high calcium (normal 10 to 11 mg. per hundred cubic centimeters). (A. H. Davis, M.D., pathologist.)

The urine examination revealed no abnormal conditions.

The preoperative blood count was as follows: hemoglobin, 82 per cent; erythrocytes, 4,410,000 per cubic millimeter; leukocytes, 6,920 per cubic millimeter; small lymphocytes, 20; large mononuclears, 9; polymorphonuclear neutrophils, 71.

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X-ray findings: Films of the right side of the mandible showed a fusiform expansion of the bone posteriorly from the right cuspid tooth. This fusiform tumefaction appeared as a more or less rounded mass, reduced in bone density. The lesion undoubtedly is bone absorbing and bone expanding. (Fig. 3.) Roentgenograms were taken of the skull in the postero-anterior and left lateral positions. Special roentgenograms were taken of the sella turcica, spotted in the lateral plane. Anteroposterior views of the femora, humeri and lower femora, to include the knee joints, were taken.

Films of the humeri, pelvis, femora and knees failed to reveal any evidence of abnormal bony structure.

The lateral view of the skull revealed a marked increase in the density of the inferior part of the temporal region, also the superior and middle parts of the frontal bone. There is evidence of both bone destruction and proliferation in the inferior frontal and orbital regions.

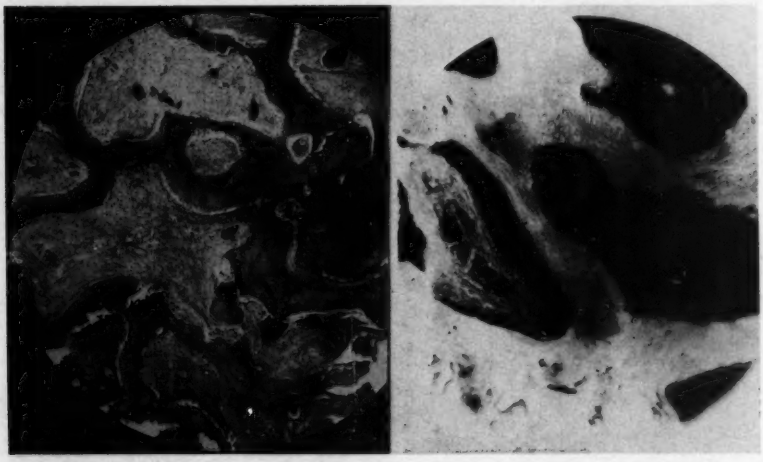

Fig. 6.—Left, photomicrograph showing great increase of fibrous tissue and appearance of bone in bands. (From biopsy of mandible.) Right, another photomicrograph showing dystrophic bone along with fibrous marrow.

The postero-anterior view of the skull reveals evidence of bone destruction in the orbital regions bilaterally, and the frontal and parietal regions on the right side. There are small circumscribed areas of rarefaction throughout the area previously described. There are a few circumscribed areas of rarefaction at approximately the middle of the left parietal bone, immediately laterally from the sagittal suture. (Figs. 4 and 5.)

There appeared to be small circumscribed areas of rarefaction along the body and ramus of the mandible on the right side.

Spot films of the sella turcica revealed that it was unusually small. There appeared to be virtually complete bridging. (E. L. Warren, M.D.)

Biopsy.—November 20, the following operation was performed: A soft tissue

flap was elevated to expose the buccal side of the tumor mass. A block section of the lesion was excised. The bicuspid and first molar teeth were extracted. The central portion of the tumor mass consisted of soft brown semidegenerated bone, which was removed easily with a curet. The body of the lesion was consistent with a partially calcified tissue. The soft tissue flap was sutured to position and iodoform gauze was inserted in the wound. The tissue was sent to the laboratory for microscopic examination.

Laboratory Report: The specimen consisted of several fragments of spongy bone, the total about 1.5 cm. in diameter, also a tooth not remarkable grossly. (Tissue submitted November 20.)

Microscopic examination: The most characteristic feature was a great increase of fibrous tissue, giving the bone a spongy appearance. The haversian canals were dilated and filled with fibrous tissue. No foci of hemopoiesis

Fig. 7.—Right side of mandible eight months after biopsy; showing lack of bone calcification.

could be found. The bone appeared in bands or spicules. Some of the spaces within the bone were lined with osteoblasts and new bone was apparently being laid down. The fibrous tissue within the marrow spaces and haversian canals was made up of spindle shaped cells rather closely packed together. No giant cells were present. (Fig. 6.) (A. H. Davis. M.D.)

Treatment and Progress.—The patient was under weekly treatment and observation from the date of the first biopsy to the following July (1940). During the eight months, the tumor area appeared to heal, with granulation tissue, but without noticeable calcification. The lesion remained moderately tender,

but without sharp pain, so that the patient was able to continue with her duties as a school teacher. Roentgenograms taken of the jaw lesion July 25 revealed the lack of bone calcification within the tumor area. (Fig. 7.) July 27, the patient was referred for consultation to George T. Pack, director of the Tumor Service at the Paterson General Hospital. At this time, Dr. Pack suggested and outlined a course in deep x-ray therapy for the lesion in the mandible.

X-ray therapy: Beginning July 27, one treatment with high voltage x-rays to the right side of the mandible was given every forty-eight hours for a total dose of sixteen roentgens as follows: 400 roentgens, 200 K. V., 0.5 cubic millimeters, 1 mm. aluminum, 50 cm. target skin distance, 6 cm. cone, 30 milliamperes for 4.9 minutes. The patient developed the usual edematous inflammatory reaction to the x-ray therapy. These symptoms subsided uneventfully with the usual care.

Further treatment and progress: The systemic treatment consisted of administration of vitamins A, C and D, with stress on forced calcium. The diet

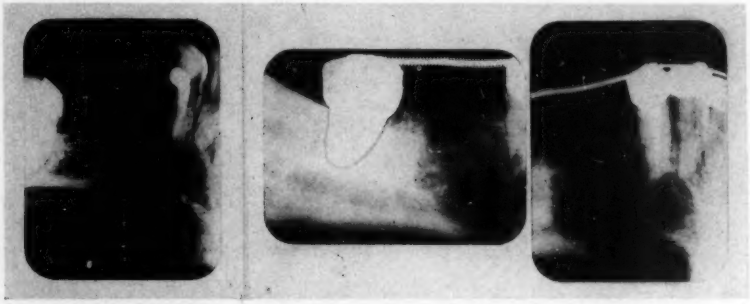

Fig. 8.—Left, appearance of bone six weeks after deep x-ray therapy; showing liquefaction of lesion. Right, absence of new bone in lesion area.

was balanced accordingly. Infrared and ultraviolet short wave diathermy applications to the mandibular lesion were given alternately.

The x-ray study of the mandible taken six weeks after the termination of the deep x-ray therapy (August) revealed complete decalcification, with liquefaction of the tumor mass. (Fig. 8, left.) There is now present a pathologic fracture of the mandible at the site of the lesion. The fluctuating mass involving the lesion was incised for drainage and the contents were cultured, the laboratory report being as follows: The specimen, received in the laboratory August 29, consisted of a slide with smear from aspiration biopsy specimen stained with methylene blue. Microscopically, the smear showed degenerated structureless material and an occasional lymphocyte and polymorphonuclear. No tumor cells were present. (A. H. Davis, M.D., pathologist.)

In September, because of the pathologic fracture of the mandible through the lesion area, an orthodontic appliance consisting of labial arch bars was placed in position. Intermaxillary elastics were used to stabilize the teeth and

jaws in a functioning occlusion. (Fig. 9, left.) M. P. Breidt, orthodontist, carried out the orthodontic therapy.

A roentgenographic study made November 11 revealed calcification of tissue in the lesion area of the mandible. The fractured fragments also showed satisfactory stability. (Fig. 8, right.) The orthodontic splint was still in position for retention of occlusion as there was a tendency to shifting of the mandible toward the right apparently due to contraction of the healing wound.

The care of the patient for the past eight months (July 1941) had consisted of continued vitamin therapy, with the usual oral hygiene. Roentgenograms taken July 28 revealed progressive calcification of the lesion area of the mandible with evidence of new bone formation. (Figs. 9, right, and 10, left.) The patient had continued with her teaching and appeared in good mental and physical condition.

Laboratory findings at this time were as follows: Sedimentation, normal; blood calcium, 9 mg. per hundred cubic centimeters of serum; inorganic

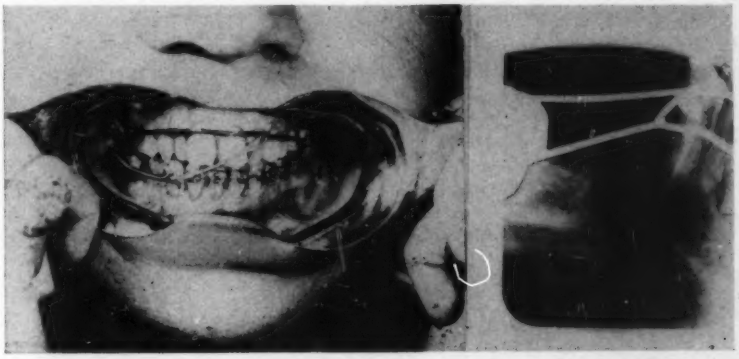

Fig. 9.—Left, orthodontic appliance with intermaxillary elastics for retention of occlusion. Right, new bone deposition in lesion area; appliance in position.

phosphorus, 3.76 mg. per hundred cubic centimeters; total phosphorus, 5.80 mg. per hundred cubic centimeters; phosphatase, 2.04 units (Bodansky) per hundred cubic centimeters (figures within normal range). (A. H. Davis, M.D., pathologist.)

January 1942: During the past six months, the usual systemic and oral care was continued. Improvement was progressive, with deposition of new bone in the area of the lesion in the mandible. The orthodontic appliance was removed and the fragments were revealed in a stabilized union. Roentgenograms taken at this time revealed the addition of new bone. (Fig. 10, right.)

The last clinical examination of the patient was made June 26. The mandible showed a stabilized union, clinically, with a good resulting functional occlusion of the teeth and jaws. The patient was in good condition mentally and physically.

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COMMENT

The terminology with respect to the group of lesions known as osteofibroma has varied in the past. The term localized osteitis fibrosa has been used more commonly in the literature. It is quite possible that this may be due to the histologic status of the lesion at the time of the microscopic examination. The terms used have varied in relation to the tissue change which was characteristic of the lesion during its different periods of tissue formation. The predominance of the fibrous and osseous tissues had a bearing on the terminology.

It is of interest to note the result of deep x-ray therapy with respect to the osteofibroma. This form of treatment for these lesions is still in the experimental stage. The reported osteofibroma had undergone dissolution with complete liquefaction resulting in pathologic fracture of the mandible,

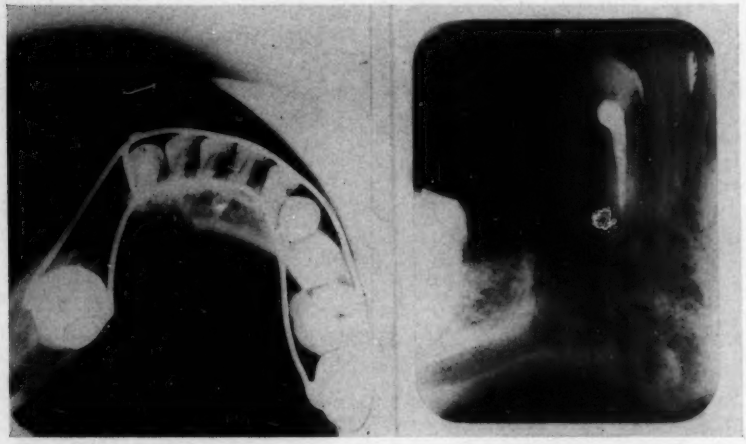

Fig. 10.—Left, occlusal view; showing position of bone fragments and calcification in lesion area. Right, deposit of new bone in lesion area; fragments in stabilized union.

following x-ray treatment. This was followed by a slow but definite regeneration of bone, with union of the fragments and no resultant functional deformity. It is important to note that the regeneration of bone was a slower process than was noticeable in traumatic fractures. Dr. Pack believes that sectioning of the tumor mass may still be required, with a bone graft for retention of the fragments in normal apposition.

The case reported herein is of further interest because it presented symptoms of two unusual lesions in one person; namely, osteofibroma of the mandible and leontiasis ossea of a portion of the skull. The former lesion appears early in life, while the latter appears around puberty. In

the foregoing report, the patient was intelligent and in reasonably good financial circumstances, and had had repeated examinations, but still the symptoms were not detected.

The symptoms of leontiasis ossea, as illustrated in the foregoing case report, are limited to a hyperostosis of a part of the skull and are particularly unilateral. Paget's disease is excluded because of the lack of extensive symptoms of osteoporosis, and there is no relationship to Recklinghausen's disease because of the absence of abnormalities in the blood calcium and phosphorus or in the remainder of the skeleton.

SUMMARY

In the foregoing case report, symptoms of two unusual diseases were present in one person; namely, osteofibroma of the mandible and leontiasis ossea of a part of the skull. Deep x-ray treatment of the mandibular osteofibroma resulted in liquefaction of the mass, with later calcification of the tissues and bone healing within this same area. The evidence indicates that conservative treatment medically and surgically and deep x-ray therapy are the soundest course for this group of lesions at the present time.

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ANATOMIC CONSIDERATIONS IN LOCAL ANESTHESIA

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THE discovery of anesthesia by a dentist in December 1844 marks one of the greatest epochs in the history of dentistry. Since then, the progress of anesthesia has been rapid and continuous. Only forty years later, in 1884, the anesthetic properties of cocaine were discovered. In 1905, procaine was introduced to the profession and was found to have many advantages over cocaine. Procaine, proving itself to be safer than cocaine, has been universally accepted by the dental profession. Monocaine, which also has the properties of a vasoconstrictor, has been introduced. In a 1 per cent concentration, it is less toxic than 2 per cent procaine and requires smaller percentages of epinephrine to assure satisfactory results.

In spite of the strides made in local anesthesia, many dentists are still experiencing difficulty in the administration of local anesthetics. It is true that, with the earlier solutions, considerable time elapsed before anesthesia was complete. It is also true that administration of those solutions did not, in every case, produce anesthesia of sufficient depth to eliminate all pain. With the newer solutions available, we can no longer blame the composition of the anesthetic for incomplete anesthesia. We know today that every dental operation can be performed without actual pain. Patients are demanding not only that teeth be extracted painlessly, but also that the teeth be filled painlessly.

The administration of local anesthetics for operative procedures is gradually becoming more widespread in the dental profession. There are instances, however, in which the dentist finds that injection of an anesthetic solution fails to bring about the required degree of insensitivity of the pulps of the teeth to be operated on. A review of the literature and texts on local anesthesia reveals that volumes have been written on the subject as applied to extractions, but little attention has been paid to anesthesia for operative dentistry. Those who have used and taught the use of local anesthesia for operative procedures are well aware that injection technics affording anesthesia satisfactory for extractions will not always assure anesthesia profound enough for cavity preparation or vital pulp extirpation.

Failure to obtain profound anesthesia of the pulps of the teeth is primarily due to a misunderstanding of the innervation of the teeth and anatomic variations of the jaws. Pain impulses from the teeth are transmitted by sensory nerves and may be inhibited by placing the anesthetic solution as

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close to the nerve trunk as p sible. To obtain profound anesthesia, therefore, requires complete knowledge of the nerve supply to a given area and the structures through which the needle must pass.

INNERVATION OF THE MAXILLARY TEETH

We have been taught that the maxillary teeth have only one source of nerve supply: the posterior-superior alveolar branches of the superior maxillary nerve and the middle superior and the anterior superior alveolar branches of the infra-orbital nerve, which anastomose to form the superior dental plexus. Few of us have dared to question the statements in the standard texts of anatomy or to consider that possibly the maxillary teeth may be innervated by more than one nerve.

Stewart,[1] in his treatise "The Innervation of the Dental Tissues and Its Importance in Regional Anesthesia," says:

> The innervation of the maxilla is not as well understood as the nerve supply of the mandible. . . . Most parts of the body are innervated by more than one nerve, and we see no reason to believe that the jaws and teeth are exceptions to this rule.

Steinfelder,[2] in his paper "Problems in Local Anesthesia," says: "The nerves supplying the palate often penetrate sufficiently deep to reach the peridental membrane, from which structure nerve fibers may pass through the apical foramen, thus directly innervating the pulp of the tooth." Accordingly, then, the anterior palatine nerve supplements the nerves of the posterior maxillary teeth, beginning with the cuspid. Therefore, to completely anesthetize the pulps of the posterior maxillary teeth will require an injection of the anterior palatine nerve to supplement the buccal injection of the outer nerve loop.

Professor Fischer,[3] in his text "Local Anesthesia in Dentistry," points out that the nasopalatine nerve has a definite relationship to the pulps of the maxillary incisors. Fischer says:

> Anesthesia of the nasopalatine nerve has a special significance because of the relationship of this nerve with the pulps of the upper incisors. Since its trunk also gives off fibers to the pulps of these teeth, infiltration anesthesia at the nasal spine alone does not always guarantee complete success.

In our studies in the Department of Anatomy at Wayne University Medical School, we found that the course and relations of the nasopalatine nerve differ materially from their presentation in standard texts on anatomy. The following description of the nasopalatine nerve is based upon these studies.[4]

The nasopalatine nerve enters the nasal cavity through the splenopalatine foramen and runs anteriorly between the mucous membrane and the periosteum in a groove on the vomer to the foramen of Scarpa. Before entering the foramen of Scarpa, it gives off a branch which runs anteriorly toward the anterior nasal spine.

Within the nasal third of the incisive canal, another branch is given off

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which follows a very fine canal and terminates in the pulps of the central and lateral incisors. The main nasopalatine nerve continues on through the incisive canal and exits on the palate through the incisive foramen. From the incisive foramen, it runs posteriorly as far as the cuspid, where it anastomoses with the anterior palatine nerve.

The two nasopalatine nerves ramify the premaxillary bones and innervate the incisors and palatal alveolar plate, periosteum and mucous membrane over the incisor and cuspid teeth on each side.

Our experience with local anesthesia indicates that the anterior superior alveolar nerve innervates the maxillary cuspid and the labial mucoperiosteum and alveolar plate in the region of the incisors and cuspid. Occasionally, fibers of this nerve reach the apical foramen of the incisors, and these teeth thus have a dual innervation.

Injection high up in the incisive canal is necessary to anesthetize effectively the maxillary incisors. A supplementary injection on the labial aspect over the apex of the incisors is occasionally necessary to block off fibers of the anterior superior nerve that may reach the apical foramen of these teeth.

The maxillary cuspids may receive a triple innervation from the anterior superior alveolar nerve and the terminal fibers of the nasopalatine and anterior palatine nerves. The anterior superior alveolar nerve, however, is the principal source of nerve supply for the cuspid. Maxillary cuspids that are to be anesthetized must be injected on both the labial and the palatal aspect over the apex.

In incomplete anesthesia of the maxillary incisors after infra-orbital nerve block injection, the reason for failure is obvious when we consider the newer concept of the innervation of these teeth.

MAXILLARY INJECTIONS

Subperiosteal Injections.—Subperiosteal infiltration anesthesia is advocated for the maxillary teeth. This type of injection is easy and produces profound anesthesia of the individual teeth injected. The cancellous structure of the maxilla permits the anesthetic solution to reach and to render insensitive the nerves of both the outer and the inner loops by means of an infiltration injection.

The supraperiosteal injection is recommended by certain teachers and writers. We have found it feasible for extractions; but in operative procedures involving the dentin or pulp, it does not always produce satisfactory anesthesia. We have found that, for operative procedures, the subperiosteal injection produces deeper and quicker anesthesia of the dentin and pulp, and less anesthetic solution is required because it is confined in a closer area when placed under the periosteum. The elasticity of the periosteum forces more of the solution through the cortical layer of bone into the cancellous structure, where it finds its way through the apical foramen into the pulp chamber.

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A painless technic for maxillary subperiosteal infiltration calls for retraction of the cheek or the upper lip outward and downward, insertion of the needle into the fold thus defined in the area of the tooth to be anesthetized and the depositing of a few drops of the anesthetic solution to aid in painless deep tissue penetration. After waiting about thirty seconds, the needle is advanced at right angles to the buccal alveolar plate until the periosteum is penetrated. The needle is then placed parallel to the alveolar plate, with the bevel toward the bone, and advanced slowly toward the apex of the tooth, depositing a few drops of anesthetic solution ahead of the needle. At the level of the apex, 0.5 cc. of anesthetic solution is deposited.

The injection into the palate is made in the area of the tooth to be treated at a point one-third to one-half the distance from the gingival border to the median line to the palate. This point is opposite the apex of the lingual root, and the mucoperiosteum being less adherent here than near the gingival border, entry of the needle is less painful. The needle is inserted with the bevel toward bone and the syringe directed from the opposite side of the arch. About 0.25 cc. of anesthetic solution is deposited below the periosteum.

Maxillary cuspids and bicuspids require only one subperiosteal injection over the apex of the buccal aspect of the tooth to be anesthetized. The upper first permanent molar, owing to its dual nerve supply, requires two injections on the buccal aspect, one over the mesiobuccal root and the other over the distobuccal root. The dense malar bone in this region must be avoided or the needle will be deflected outward, away from the apices of the buccal roots of the upper first permanent molar, with resultant unsatisfactory anesthesia.

The technic employed for the maxillary deciduous teeth is similar to that used for the maxillary permanent teeth except that the anesthetic solution must be deposited at a point nearer the free margin of the gum for deciduous teeth in order to place the solution as near the apices of the deciduous teeth as possible. The distance of this point above the free margin of the gum depends on the age of the child and the rate of resorption of the roots of the deciduous teeth. Surface anesthesia, to render these injections less painful, can be obtained by depositing a few drops of anesthetic solution under the mucous membrane at the mucobuccal fold. The needle is withdrawn and a second injection made near the apices of the teeth to be anesthetized.

The Tuberosity Injection.—The tuberosity injection may be given for the maxillary second and third molars. Entering the pterygoid plexus of veins in making this injection must be avoided to prevent development of a hematoma during the course of needle entry. In making the tuberosity injection, the following precautions must be observed:

1. The needle should be directed at all times at an angle of 45 degrees to the occlusal surfaces of the maxillary teeth. The needle is inserted in the

mucobuccal fold above the distal third of the second molar and is directed over the apices of the third molar.

2. The syringe is swung externally as far as the corner of the mouth will permit. The point of the needle is directed toward the posterior superior palatine foramen wherein the posterior superior alveolar nerve enters the maxilla. The anesthetic solution must be deposited at this point for satisfactory anesthesia of the second and third maxillary molars.

3. The $1\frac{5}{8}$ inch needle is inserted not more than 1 inch. If the needle is inserted too far back posteriorly, the pterygoid plexis may again be entered. The needle, when properly directed, must be at all times in lateral contact with the convex surface of the tuberosity. There are no important structures in this area, which is filled with adipose tissue. When the needle is inserted only 1 inch, the point of the needle will be approximately at the level of the posterior superior alveolar foramen.

If these three precautions are carefully observed, the needle will not enter the pterygoid plexus, hematoma will not occur and profound anesthesia will be assured.

The Infra-Orbital Injection.—The infra-orbital injection is contraindicated for anesthesia of the maxillary incisors for two reasons, the first and most important reason being that the nasopalatine nerve and not the infra-orbital nerve is the principal source of nerve supply to these teeth. The second reason that we do not advocate the infra-orbital injection is the danger of puncturing the anterior facial vein when the canine fossa is bridged by the needle in giving this injection. The ever-present possibility of a hematoma is a definite contraindication for its use.

The Nasopalatine Injection.—The nasopalatine nerve block is indicated for all operations involving the dentin or pulp of the maxillary incisors. The maxillary incisors are innervated principally by the nasopalatine nerves; therefore, it is necessary to make this injection to anesthetize the pulps of these teeth for operative work.

Since the dental branch of the nasopalatine nerve is given off in the nasal third of the incisive canal, it is necessary to deposit the anesthetic solution high up in the nasal end of the incisive canal.

Injection into the incisive canal is an easy matter and results are very gratifying provided we have a clear understanding of the position and course of the incisive foramen and canals.

The two incisive canals, through which the descending palatine arteries and the nasopalatine nerves pass, run obliquely downward from the nasal floor and converge in the palate behind the central incisors into the incisive foramen. These canals run parallel to the labial alveolar plate and will therefore vary accordingly. This is a very important point to remember in making the incisive canal injections.

The incisive papilla, indicating the position of the incisive foramen, is surrounded by a circular groove. This papilla serves as an anatomic landmark in locating the foramen.

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1. The needle is inserted in the groove encircling the papilla where the sensory nerve supply is meager and sensation slight. A few drops of anesthetic solution is deposited just below the surface to anesthetize the papilla before advancing the needle into the incisive canal.

2. The injection is started on the side of the papilla opposite the nerve to be injected owing to the oblique course of the canal.

3. The bevel of the needle is toward the distal wall of the incisive canal to insure unobstructed passage up into the canal.

4. The direction of the needle must be parallel to the labial alveolar plate.

5. The papilla being anesthetized, the needle can be advanced into the incisive canal painlessly.

6. The needle is advanced high up into the nasal third of the incisive canal and 0.25 cc. of anesthetic solution is deposited very slowly, unnecessary pressure being avoided.

7. Both nasopalatine nerves must be injected if the incisors on each side of the median line are to receive operative treatment.

8. Occasionally, it is necessary to supplement the nasopalatine block with a subperiosteal injection on the labial surface over the apex of the lateral incisors, to block off fibers of the anterior superior alveolar nerves which may reach the peridental membrane and the apical foramen of these teeth.

INNERVATION OF THE MANDIBULAR DENTITION

We have always understood that the nerve supply of the lower teeth is different from that of the upper. While the upper teeth are innervated by two distinct nerve loops, the lower teeth and their pulps and surrounding alveoli are supplied by the inferior alveolar nerve only.

Dr. Novitsky,[5] of San Francisco, has demonstrated that the mylohyoid nerve has branches which enter the mandible on the lingual surface near the genial tubercles. The mylohyoid has been considered as a motor nerve, but it must have sensory fibers as otherwise it would not enter bone. This may explain why it is impossible at times to anesthetize the incisors by bilateral mandibular block injection.

Sensory fibers of the cutaneous coli (cervical plexus) also sometimes enter the lingual surface of the mandible at a point opposite the bicuspids, and an injection at this point will often complete anesthesia of the lower molars and bicuspids when the mandibular block has failed.[6]

The mucous membrane of the mandible has three distinct sources of innervation. Lingually, the mucous membrane is supplied by the lingual nerve. Buccally, the mucous membrane of the lower molar region is supplied by the buccinator nerve. The buccal mucous membrane of the bicuspid region and the labial mucous membrane of the anterior teeth are supplied by the mental nerve, which is a branch of the inferior alveolar nerve.[7]

In determining whether numbness is present after an injection or in testing for anesthesia by compression, the mucous membrane only is accessible.

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Therefore, it is necessary that we know the innervation of the mucous membrane in order to understand which nerve or nerves have been blocked.

Numbness of the tongue would indicate only that the lingual nerve has been anesthetized. Anesthesia of the buccal mucosa of the lower molar region would indicate only that the buccinator nerve has been blocked.

Numbness of the lower lip and chin indicates anesthesia of the inferior alveolar nerve, which is evidence that the mental nerve, a branch of the inferior alveolar, was anesthetized when the anesthetic solution was deposited in the mandibular sulcus.

MANDIBULAR INJECTIONS

Block injection is indicated for all operations in the mandible, since it affords profound anesthesia and can be administered painlessly, owing to the meager sensory nerve supply at the point of needle entry. The mental injection is not advocated for lower anterior teeth because it is difficult and is painful. Infiltration anesthesia is contraindicated for operations on the mandibular teeth since the bone covering the roots on the buccal aspect of molars is usually so dense that the solution will not permeate sufficiently to anesthetize the pulps. Peridental injections and intraosseous injections are also contraindicated in the mandible. The latter are usually employed by the dentist in desperation when other injections have been tried and have failed. In the mandible, block injection, properly made, is more effective and more certain of results.

Anatomic Variations.—Successful mandibular block injection requires a knowledge of anatomic variations in the size and shape of the jaw in order that the anesthetic solution may be deposited in the mandibular sulcus.

In making the inferior alveolar injection, several anatomic variations must be kept in mind:

1. The height of the ramus varies with each individual. This is especially notable in children. The younger the child, the shorter the ramus, and the lower the point of needle entry will be. In a child 7 years of age, the point of needle entry will be approximately level with the occlusal plane of the lower teeth.

2. The direction of the needle must be at right angles to the long axis of the ramus, and therefore will vary according to the angle that the ramus makes with the body of the mandible. In children, the angle is more obtuse and consequently the plane of the needle will be directed downward. The younger the child, the more obtuse the angle.

3. The coronoid notch is one of the most important landmarks for the mandibular injection since by it we can determine the height and direction of needle insertion. The coronoid notch is the deepest point of the depression on the anterior border of the ramus. It is usually found near the point of fusion of the internal and external oblique lines.

4. The mandibular sulcus, the depression wherein the inferior alveolar

nerve enters the mandible through the mandibular foramen, is usually located about two-thirds the distance from the anterior to the posterior border of the ramus on the lingual surface. A line drawn perpendicularly to the anterior border of the ramus from the deepest point in the coronoid notch will generally pass through the mandibular sulcus above the lingula. The depth to which the needle must be inserted will depend on the anteroposterior width of the ramus, which can be determined by placing the ball of the thumb in the deepest point of the coronoid notch on the anterior border of the ramus, and the ball of the second finger on the deepest point of the notch on the posterior border of the ramus. In children, the width is much less than in adults. The younger the child, the narrower the ramus.

5. The flare of the ramus, the lateral angle which the ramus forms with the body of the mandible, varies with different individuals, regardless of age. The flare may be toward the buccal or the lingual aspect. The farther the flare is buccally, the farther the syringe must be kept distally on the opposite side of the mouth, in order to reach the mandibular sulcus with the point of the needle. Unless the flare of the ramus is determined, the point of the needle will be away from bone for a considerable distance. The possibility of contacting the pterygoid plexus of veins and producing a hematoma is always present when the point of the needle is not kept close to the ramus during the mandibular injection.

The Mandibular Block Injection.—The technic for the mandibular block is as follows: With the thumb of the free hand, the coronoid notch on the anterior border of the ramus is palpated. The ball of the thumb is held in the deepest point of this depression with the thumbnail toward the tongue. The syringe is held so that its barrel crosses the bicuspid region of the opposite side of the mouth, and with the central line of the thumbnail as a guide, the needle is introduced, with bevel toward the bone, until the internal oblique line is encountered. At this point, a few drops of solution is introduced to anesthetize the lingual nerve and make needle advancement painless. The needle is withdrawn slightly, and the soft tissues and needle are moved toward the median plane with the palpating thumb. After the internal oblique line and the temporal tendon are cleared, the barrel of the syringe is swung distally a trifle farther if possible and the needle is advanced until bone is encountered. The needle is retracted slightly and 1 cc. of the anesthetic solution is deposited in the mandibular sulcus to anesthetize the inferior alveolar nerve.

Buccinator (Long Buccal) Nerve Block.—This injection is to supplement the inferior alveolar nerve injection for the extraction of lower molar teeth, for surgery of the buccal soft tissues of the lower molar region or for painless placement of a matrix band for proximal cavities on lower molar teeth.

The commonly employed buccal infiltration injection is not indicated, for two reasons: (1) the anesthesia is not of sufficient duration for long operations and (2) the risk of injection into inflamed buccal tissue is un-

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warranted. A definite nerve block injection posteriorly from the last molar tooth is much more effective. Sloman[8] has shown that the buccinator nerve, as it leaves the sheath of the temporal muscle, crosses the anterior border of the ramus at a point approximately level with the occlusal plane of the lower molar teeth. A definite nerve block injection is made on the buccal aspect of the ramus at this point. The buccinator nerve is about 2 mm. below the mucous surface at this level. Here, the needle is inserted 2 or 3 mm., with the bevel toward bone, the cheek being drawn upward and outward, and 0.25 cc. of anesthetic solution is deposited beneath the mucous membrane. This injection may also be made at the time that the needle is being withdrawn after the mandibular block. Before complete removal of the needle, its point is swung over to the cheek side of the ascending ramus and 0.25 cc. of anesthetic solution is deposited in the region of the buccinator nerve.

Labial Infiltration Injection.—Sensation through anastomosis across the median line when lower anterior teeth on one side of the jaw are to be operated on by the aid of a unilateral mandibular block is stopped by injecting 0.25 cc. of anesthetic solution below the periosteum opposite the apex of the tooth nearest the mesial aspect to receive treatment. The site of tissue puncture is the lowest median point of the mucolabial fold when the lower lip is drawn outward and upward. A few drops of anesthetic solution may be deposited at this point before the needle is advanced below the periosteum to aid in rendering deep tissue penetration painless.

The symptoms of anesthesia resulting from the mandibular block injection are entirely sensory. It is essential, therefore, that the patient be consulted to determine whether the injection has been successful. At the expiration of five minutes, an inquiry is made as to whether anesthesia has been secured. If there is numbness of the lip and chin on the side injected at this time, profound anesthesia of the lower teeth on that side is usually assured.

SUMMARY

The experience of the past ten years in administering local anesthetics routinely to more than 200,000 patients for extractions and cavity preparation in Detroit dental clinics has disclosed the fact that many dentists experience difficulty in securing satisfactory anesthesia of the teeth. This is especially notable in anesthesia of the pulps of the teeth for operative procedures. We have found that methods which assure anesthesia deep enough for painless extractions may not produce anesthesia deep enough for cavity preparation or pulp extirpation. Much deeper penetration is necessary to anesthetize the pulp than the gums and alveolar process.

Many operators blame their failures on the syringe, the anesthetic solution or the patient rather than on their own incompetence and lack of a satisfactory technic. The best equipment and the most satisfactory anesthetic solution will not assure satisfactory results unless the solution is properly placed.

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To use conduction and infiltration anesthesia successfully, the operator must place the anesthetic solution in such a position that it readily diffuses through to the nerve trunk, to block pain impulses transmitted by the sensory nerves.

Therefore, a successful technic requires an intimate knowledge of the nerve supply to a given area and a practical method of approaching this region with the syringe needle. Also, the operator must know the anatomy of the region and be able at all times to visualize the structures through which the needle is to pass. Anatomic variations and important landmarks must be recognized, and what regions are to be entered, nerves to be anesthetized and blood vessels and muscles to be avoided must be known before an injection is started.

A few hours of careful study will pay handsome dividends and may transform the novice into a competent anesthetist.

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Surgery and Safety.—It must never be forgotten that it is the patient who pays the price of the surgeon's mistakes. From that law there is no repeal. Indeed, it might be well for us to remind ourselves constantly of a thing that we are in much danger of forgetting in these overly scientific days, that the center of the surgical universe, if I may so express it, is the patient himself. He is the person chiefly concerned in every operative act. He submits to surgery for one of two reasons, to save his life or to improve his health. He and not the surgeon is the ultimate judge of the success or failure of every operation. To him, surgery is always an evil and he wants to be certain of the necessity for it, not in an abstract case but in his own personal case. He is not grateful for the performance of a perfect technical operation if it does not happen to be indicated for the relief of his particular disease. It is quite possible, from his standpoint, to have as the end-result of surgery a perfectly healed wound and a permanently impaired function.—C. Jeff Miller, in *Am. J. Surg.*, August 1931.

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FRACTURES OF THE MAXILLAE

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THE bones of the face appear to be involved in traumatic injuries with increased frequency as rapid means of transportation develop. The war casualties have still further increased the incidence of these injuries. The prominence of the maxillary bones, situated as they are in the most exposed part of the face, renders them particularly liable to injury. The anatomic structure and the relationship to other bones of the head give the upper jaw a great deal of strength in relation to its weight of structure. The central part of the maxillary bones is hollow, constituting the maxillary sinuses, but the lateral walls of this area are buttressed against the adjacent bones of the face. The muscle attachments to the maxillary bones play little part in accentuating the injuries that may occur to these bones. It is only rarely that the internal or external pterygoid muscles are able to exert a displacing influence in fractures of the maxillae, because of the mechanical nature of such fractures. It takes more than a simple blow to cause a fracture or displacement of the maxillary bones.

Most maxillary fractures are associated with automotive transportation. The typical injury results when a driver or passenger is thrown forward while in a sitting position, striking a rigid part of the car when it is involved in a collision with a stationary object or another moving vehicle. The impact throws the passenger forward, usually bending from the waist with the legs partially braced in a sitting position. As most passengers face forward while traveling, the face is often the first part of the body to receive the impact with a fixed object. The direction of such force is anterior-posterior, either horizontally or obliquely from above downward.

In the military services, maxillary fractures are sustained as the result of automotive casualties in tanks, trucks or motor lorries, motorcycles or aeroplanes. Personal combat with the bayonet or musket may account for a few fractures. Gunshot wounds from rifle, machine gun or high explosive fragments cause many fractures of the maxillary bones, and a large percentage of such wounds never get to the treatment stage because many are fatal. The fatality rate is much higher when the missile strikes in an anterior-posterior direction than when it travels laterally across the face.

Sports are responsible for a small number of maxillary fractures from such games as football, baseball, hockey, lacrosse and tennis. Protective devices and changed rules have made sports much safer than formerly. Industrial accidents to the face are not very common, except in mining and the heavier industries. Falls are responsible for many of these accidents.

Many fractures of the maxillae also involve injury to the nasal bones and

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cartilages, and most maxillary fractures involve the maxillary sinuses. The bony walls of the orbit may be included in fractures when the direction of the force is from above downward. The palatal bones are often involved in unilateral fracture of the maxilla. Fracture of the tuberosities of the maxilla is not common from external traumatic forces, but the tuberosities are not infrequently fractured in the extraction of maxillary third molar teeth when undue force is exerted toward the posterior aspect.

Fig. 1.—Author's adhesive plaster chin strap applied over modified Barton bandage. The ends of the strap are reinforced with cardboard. Safety pins provide an attachment for rubber bands to secure traction upward.

Fractures of the maxillae resulting from force in a horizontal direction are frequently impacted or depressed. They may be unilateral or bilateral, in accordance with the direction of the force. If the force is oblique, from above downward, there may be a complete horizontal fracture, with separation and downward displacement of the maxilla, either unilateral or bi-

lateral. In such a case, the teeth are movable up and down *en masse,* very much like a denture.

Gunshot wounds of the maxilla are usually atypical. There is often marked comminution of the bones. More often, there is a fairly clean penetrating wound involving the bones, because of the hollow structures of the maxillae and the lack of dense areas of cortical bone, which is more liable to comminution. A great deal of destruction of the maxilla may be caused by passage of irregular missiles of shell fragments through the area. Rifle bullets may pass through the maxilla with but a clearly drilled hole resulting.

Fig. 2.—Modification of the appliance, originally suggested by James B. Davidson, Newark, N. J., used as adjustable head appliance for reduction of displacement and immobilization of complicated fractures of maxilla and other facial bones.

Fracture of the maxillary bones is usually associated with contusions or lacerations of the face and often is accompanied by marked ecchymosis and edema of the soft tissue of the face, particularly about the eyelids and in the infra-orbital areas. This marked swelling may often obscure any deformity in the early periods. Bleeding from the nose, which may be present, may indicate extension of the fracture into the maxillary sinuses, or it may be

caused by fracture of the nasal bones or the base of the skull. Deformity of the dental arch or abnormality of the occlusal plane of the teeth may be one of the visual evidences of displaced fragments. Abnormal mobility may, on manipulation, be elicited in some of the maxillary displacements. Crepitation may be felt where the maxillae are movable, but more often this symptom is not detected. In some cases of unilateral fracture of the maxilla, there may be a fracture through the palatal suture, or one side of the palate may be higher than the other. Fractures involving only the alveolar process may show movement of the block of teeth *en masse* without movement of the palatal area.

The diagnosis should be based on the clinical findings of deformity and abnormal mobility and on the roentgenographic findings. The roentgen examination is not always conclusive because there are so many areas of

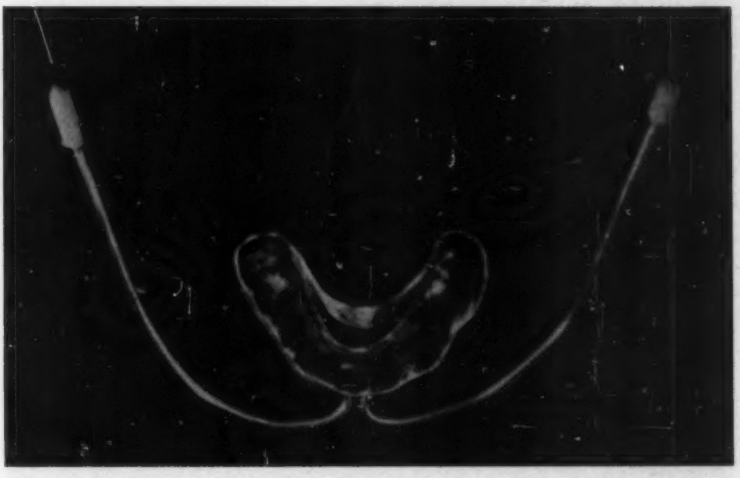

Fig. 3.—Kingsley splint made of cast silver with only partial coverage of palate and extra oral arms attached to anterior portion of splint for attachment to headcap appliance.

superposition of parts as seen in the roentgenogram. The stronger x-ray units in hospitals and in the hands of roentgenologists are much more satisfactory for diagnosing maxillary fractures than the units found in most dental offices. Postero-anterior plates are more satisfactory than lateral plates, even though there is a superposition on the spinal column. Intra-oral occlusal films are often of great value in showing such areas as the palatal or alveolar parts of the maxilla. Stereoscopic plates will often bring out the relation of depth, a third dimension that cannot be seen otherwise. Foreign bodies, in cases of gunshot injury, can also be localized in this way and their removal facilitated.

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Treatment of maxillary fracture must be based on the evaluation of the roentgenogram, with the fracture lines, displacement of parts and involvement of the nose, eye, sinus and mouth evident. Whether the teeth are present and the displacement is posterior or downward will do much to determine the type of fixation or traction to be employed.

A fracture of the maxilla which shows no displacement of the parts and in which there is a normal occlusal relationship of the teeth may not need any type of stabilization or fixation. No ordinary muscle pull will displace the fragments in such a fracture and the only treatment of the patient is rest of the parts by avoidance of masticatory stress. Some treatment of the overlying soft tissue may be indicated.

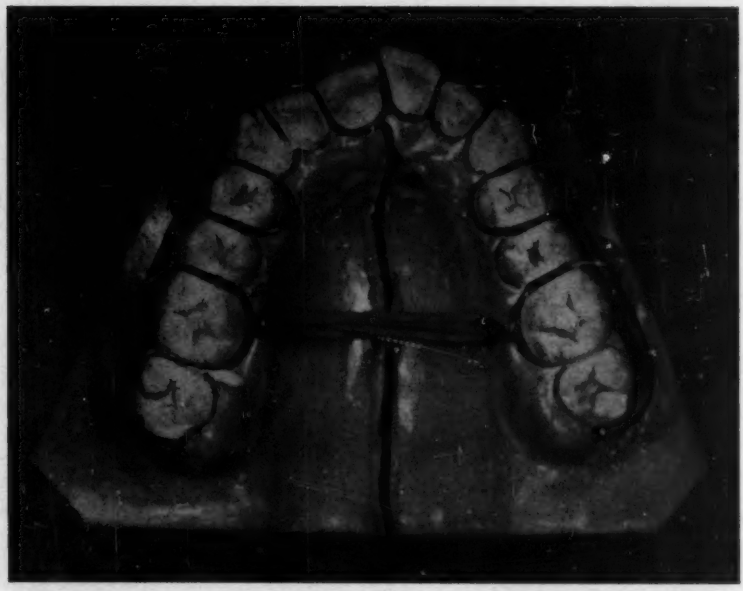

Fig. 4.—Rubber band traction used to approximate lateral halves of maxillae when separated at median suture (line).

If there is displacement and involvement of the maxillary sinuses, intranasal treatment to shrink the nasal mucosa and the use of 20 per cent mild silver protein (argyrol) in the nose may aid in aborting the infection of the intra-antral hematoma which usually is present. Early irrigation of the sinus is not indicated, unless there is evidence of infection.

Fracture of the maxillae when teeth are present in the mandible and maxillae lends itself to the following methods of treatment, if there is downward displacement. First, the mandible may be used as the means of forc-

ing the maxilla into position, by utilization of traction on the chin by means of a head appliance. By this method, the maxilla is more apt to seat itself in a normal occlusal relationship. A simple technic employing this method is my own utilizing an adhesive plaster chin strap with a semicircular section cut out to relieve pressure on the trachea and larynx. The ends of the strap

Fig. 5.—Single heavy wire facebow attached to plaster headcap. By bending the facebow, the proper forward direction of the rubber band or wire traction can be attained.

are reinforced with cardboard strips through which safety pins are inserted. (Fig. 1.) This strap is placed over a few turns of gauze applied as a modified Barton bandage. Two additional adhesive straps are carried over the

bandage, a 2-inch space being left between the end of the chin strap and the ends of the additional straps crossed over the vertex. Cardboard and safety pins are used in the end of the upper straps and elastic bands are adjusted over the safety pins on each side to attach the chin straps to the head straps. This gives constant upward traction and the tension can be adjusted by the length of the elastic bands or the number of turns taken around the safety pins. Various commercially made head appliances (Fig. 2) can be used later where available, in connection with chin straps or cups. If chin traction is used for a lengthy period, the chin should be padded or tension should be relieved periodically to avoid circulatory pressure and the development of soft tissue sores resembling decubital ulcers. A second method to reduce depressed fractures employs a Kingsley splint attached to the maxillary teeth. Such a splint can be made of molded plastics or cast metal with lateral arms attached. (Fig. 3.) These arms should be attached in such a manner that they are on the same level with the normal lip line. In this way, they will cause a minimum of irritation to the corners of the mouth. These lateral arms should be long enough to be bent to follow the contours of the cheek as far as the mastoid area. The upward traction is then adjusted by two straps or elastics on each side attached to a fixed head appliance. In the use of a Kingsley splint, the adjustment of traction must be such that the proper occlusal plane is maintained. If the tension is too great on the anterior portion of the splint, the result will be an open bite when the splint is removed. The third method of treatment of maxillary fractures employs direct traction wires attached to teeth or segments of bone and carried through the soft tissues of the cheek high up in the malar area. These wires are then attached to a fixed head appliance for stabilization. This direct wiring technic is used only in multiple fractures in which retention in normal alinement is difficult or where use of a Kingsley splint is not practicable.

When there is a separation of the median palatal suture with separation of the maxillae, a labial arch wire (Fig. 4) can be employed, with interproximal hooks attached, to be used with elastic bands exerting constant pressure to close the space between the lateral halves of the palate. If the patient is edentulous, the case can still be handled in a similar manner to those in which teeth are present, by using the patient's own dentures, if they are available. To wire the dentures together, small holes are drilled in each one for the passage of connecting wires. Chin traction can then be applied. In an edentulous case, a Kingsley splint can be made from an impression of the upper jaw. In an emergency, a Kingsley splint can be made by utilizing an upper impression tray with the handle cut off and lateral arms soldered onto the tray. The impression tray is filled with softened impression compound and used in that manner.

If there is a posterior displacement of the maxillary bones, due to impaction or a crushing injury, it may be necessary to use anterior traction. In such cases, the maxillae should be brought forward as early as possible, by

manual manipulation if possible. Anchorage in the maxillae may, in many cases, be very difficult. In the crushing type of injury, the anterior teeth and alveolar process are often so badly fractured that they cannot be used for any type of anchorage. Posterior teeth, if present, may be used for anchorage by employing a cast or molded splint or a labial arch, which is curved around the last posterior tooth. The fixed point of stabilization for traction must of necessity be the head, with traction arms extending downward in such a position that the pull will be in a straight line in a direction that will overcome the deformity. (Fig. 5.) Any head appliance that has leverage from in front of the face has to have adequate anchorage under the curvature of the occiput. Otherwise, the head appliance is apt to rotate forward owing to the leverage of the traction arm. In using traction arms in front of the face, it is important that the vertical wires or arms be kept from the field of direct vision. This can be done by carrying vertical attachments downward in the anterior temporal area which supports an adjustable facebow; or the arms and facebow may be one heavy wire attached to a plaster headcap and bent into the proper position for attachment of traction elastics or wires.

When the displacement is marked by a well-defined depression of the part, either downward or posteriorly, there may be some difficulty in exerting traction. In some of these fractures, a screw eye has been employed in such areas where there is sufficient thickness of bone to hold the threads of such a screw. The bone over the anterior wall of the maxillary sinus is often not thick enough to hold the threads of a screw when traction is to be used. The depressed fractures of the maxillae often involve depressions of the malar bone, which has to be elevated upward or forward. One method of accomplishing this is incision in the temporal area close to or just above the hair line. By blunt dissection along the temporal fascia, a stiff curved instrument, such as a urethral sound, can be introduced and, with a towel folded as a cushion over the temporal area, this can be used as a fulcrum and the malar bone can be elevated by force of the sound. In some cases, it may be advisable to replace depressed portions of the maxillae by an operation through the outer wall of the maxillary sinus, similar to the Caldwell-Luc operation. Through such an opening, a blunt instrument can be introduced to forcefully elevate the external wall. In such cases, when the outer wall is badly comminuted, it may be necessary to support it by firm packing of iodiform gauze into the sinus to support the external wall.

When the maxilla has been displaced downward with a lowering of the floor of the orbit, it is particularly important to raise the orbit either by elevating the entire maxilla with the orbital floor or by the support of a graft. If the orbit is not elevated, there may be a resultant diplopia, with impaired vision. Vilray Papin Blair has used a wedge-shaped piece of cartilage under the globe of the eye to correct some of these conditions. The thickened part of the wedge is placed under the posterior area of the socket to lift the orbit upward and forward.

In fractures of the maxillae, it is seldom necessary to apply traction or to

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employ splints for longer than three weeks except in the unusual case of multiple fractures in which it is hard to maintain apposition with adjacent bone.

When there has been extensive loss of bone in fractures of the maxilla, such as occur in some gunshot wounds or war casualties, it is important to incorporate adequate support for the overlying soft tissue with the stabilizing mechanism. If some means of skeletal support for the overlying tissue is not provided, there is apt to be collapse and contraction of soft parts, which it may be difficult to overcome in the ultimate reconstruction of the face. This involves a knowledge of the possibilities of surgical prosthesis and the technic of its design and planning. It is often necessary to epithelialize some of the areas within the mouth where destruction or adhesions have taken place in order to employ the surgical prosthetic appliances to best advantage.

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Mode of Resistance of Facial Bones to Fracture.—Le Fort draws the following conclusions from the clinical and experimental evidence, "the latter being infinitely more valuable." The upper jaw, in spite of its multiple attachments to the base of the cranium, possesses a considerable degree of independence. As has been frequently stated, the upper jaw is designed to transmit to the base of the skull the constant physiological stresses imposed upon it by the mandible. These are distributed by bony columns over a large surface of the cranium. On each side, the zygomatic bone like the keystone of an arch, and almost the only part exposed to lateral violence, distributes the forces over a wide area extending from the maxillary bones to the base of the skull. But as there are a number of weak points, or rather lines of weakness, the face may be separated from the cranial base or may itself be broken into fragments so that the force is dissipated and the bony envelope of the brain remains intact. . . . It is possible to derive from this study the general conclusion that severe fractures of the face, far from presenting pictures which elude description, follow simple rules, present several characters in common, and can be grouped into a small number of characteristic types.—Experimental Studies upon Fractures of Upper Part of Face, by Réné le Fort; translated by James and Fickling, in *Brit. D. J.*, 1941.

UMI

VITALLIUM BONE SCREWS AND APPLIANCES FOR TREATMENT OF FRACTURE OF THE MANDIBLE

HENRY M. BIGELOW,* D.D.S., Fort Devens, Mass.

IN July 1940, I introduced a new method of treating certain types of mandibular fracture.[1] In brief, a vitallium screw is inserted through the skin, into the mandible, and is fastened to external splints. During the past two years, I have used this treatment wherever it has been necessary, and have developed some appliances that increase its usefulness and ease of manipulation.

There are certain types of mandibular fracture that tax the ability of the most skilled operator, and only with this type is it necessary or desirable that vitallium screws and external splints be used. Whenever it is possible to use splints, Barton's bandages, arch wires or fracture bands, it is unwise to employ a more complicated or dramatic method.

In general, the types of fracture requiring this treatment are those of edentulous mandibles and fractures posteriorly from the teeth. These may be third molars or any other teeth such as cuspids or bicuspids.

Fracture of edentulous jaws may be single, multiple, compound, comminuted, impacted, simple or complex. A single fracture of an edentulous mandible can be treated in many cases by bandages and splints. However, when such a fracture occurs in the ramus or the region of the angle, it requires more complicated treatment. Fracture of the ramus or angle usually presents esthetic and anatomic deformities, because the posterior fragment overrides, anteriorly and laterally, the body of the mandible. This is due to the action of the temporal and masseter muscles, with insertions on the ramus causing this fragment to rise, while the insertions of the mylohyoid, the geniohyoid and the anterior belly of the diagastric muscles pull the body of the mandible downward.

When multiple fracture occurs in edentulous jaws, difficult problems in alinement and retention arise. These fractures always result in marked deformity, due to the displacement of the several fragments.

Fracture of the mandible containing teeth is generally not so complex and difficult to manage as fracture of edentulous jaws. However, when the mandible or maxillae are edentulous, or when there is no upper denture and one cannot be constructed owing to trauma, these jaws must be treated as if they were edentulous. Also, whenever there is a fracture at the angle or posteriorly from the last tooth, some method must be used

*Captain (DC), U. S. Army.

1. BIGELOW, H. M.: *M. Bull. Vet. Admin.*, 17:54-56, July 1940.

to hold the ramus in alinement. As this obviously cannot be done by intermaxillary wiring, with arch wires, radical surgical methods must be employed. Whenever there are upper posterior teeth and the fracture occurs in a region anteriorly from the lower first molars, a splint can be used to control the edentulous posterior fragment.

Several procedures have been used to treat such fractures. Circumferential wires passed around the fractured parts of the mandible and the splints are held in apposition with the upper denture or splint by means of a bandage about the head. This procedure is somewhat difficult, and some infection may develop about the wires, and may extend into the line of fracture.

By another method, the fragments of the mandible are brought directly together with silver wires. This can be done either intra-orally or extra-orally. When it is done from the inside, the wire is exposed to a contam-

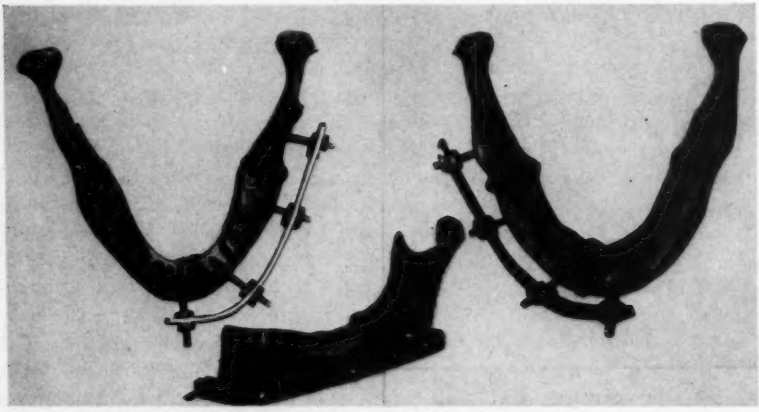

Fig. 1.—Occlusal, lateral and submandibular views of vitallium screws and external strap iron or dural splint.

inated field. (Many men have found this method very satisfactory for selected cases.) When it is done from the outside, a large incision must be made, and a scar will remain. In either case, it is usually necessary to remove the wires because they interfere with the wearing of dentures. If there is a bilateral fracture, both sides of the mandible must be wired, and, with the mandible thin, as it usually is in edentulous patients, the anterior part may drop down, owing to the pull of the inframandibular muscles. This has much the mechanical effect of trying to wire unsharpened pencils end to end without overlapping.

When it is necessary to pull the ramus into place, a wire can be inserted in the region of the angle and fastened to a headcap. This is a good

method, but it is necessary to make a fair-sized incision in order to drill a hole through the angle and to pass a wire through it and the skin. At the same time, there is the danger of incising the facial nerve and causing permanent paralysis. To each one of these methods, there are certain objections, and because of the difficulties of operation, surgical risks and frequently discouraging results, we looked for a technic that was simpler and less liable to be associated with infection, and with a better prognosis. The

Fig. 2.—Author's improved appliance, consisting of vitallium screws with slotted threaded heads that just accommodate square alinement bar; occlusal and lateral views of appliance on mandible.

vitallium bone screw has, in our experience, best met the requirements.

The technic for insertion of the screws is as follows: A screw of sufficient length and a bone drill small enough to allow full-sized threads are prepared. A small incision is made through the skin and muscle over the

part of the mandible into which the screw is to be inserted. The drill is then passed into the bone for a depth of at least one-fourth inch, which is sufficient to resist necessary stress. The drill is not passed through the bone and into the oral cavity, since this would cause infection. If the incising and drilling have been properly done, there is little tissue damage. The screw is then inserted to the full depth of the drilled hole. The nuts should be left on the screws to prevent spreading of the slot when the screw driver is applied. Whenever possible, the screw should be placed under the inferior border so that the scar will not be apparent. Obviously, the entire procedure must be aseptic. Collodion is applied at the junction of the skin and the screw.

The use of vitallium screws fastened to a head cast by wires is sufficient in the management of almost any fracture. An excellent headcast, and one that is readily available, is a football helmet, to which has been fastened the necessary wires. The helmets, of several sizes, are well fitting and well

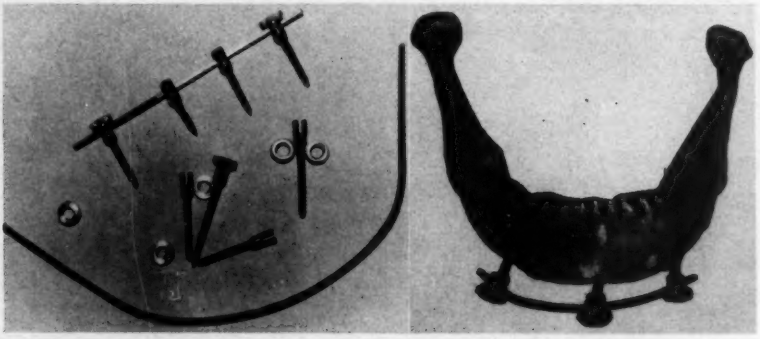

Fig. 3.—Author's appliance, vitallium screws with slotted heads, thumb nuts and alinement bar; assembly on mandible; screws inserted vertically in lower border. The usual technic is horizontal insertion into the buccal surface.

ventilated. Heavy wires can be passed directly through the ventilation holes. The use of the helmet was suggested to us by Maj. John C. Hampson, Dental Corps, U. S. Army, and it is a great improvement over the plaster headcap formerly used.

In a previous article,[1] I suggested that the screws be used in conjunction with an external splint constructed of strap iron and containing holes spaced about one-half inch apart. This can be replaced with dural, one-sixteenth inch thick and three-eighths inch wide. When shaped to the mandible and attached to the screws, this splint can be used for single or multiple fractures. (Fig. 1.)

I have since developed another appliance which gives excellent results. It consists of an alinement bar about one-tenth inch square. The screws

have slotted heads, which just accommodate the bar, and a nut to fasten the bar firmly in the slot. This is used to hold the reduced fragments in position. The bar, which is outside the skin, can be attached to the head-cap if necessary, and the screws inserted in the fragments. There is no movement or rotation of the screw or bar in any direction. Our rigid appliance is very simple, inexpensive and light in weight. The screws, nuts and alinement bars can be obtained from the manufacturers of vitallium. (Figs. 2 and 3.)

Such an application can be used in the mouth, but its use is strongly discouraged. The screws always loosen because of continuous exposure to the oral flora and the resulting infection. It is also very difficult to drill

Fig. 4.—Fracture and position of vitallium screws in the mandible; traction wires attached to screw as for fixation shown in Figure 5.

the holes intra-orally and to insert the screws in the correct position.

A roentgenogram of a patient who had a fracture of four months' duration when he came in for treatment revealed that there was fibrous union, with obvious infection. It was necessary to exert a great deal of pressure over a period of eight weeks to bring the fragments into alinement. (The negative reaction is shown in Figure 4.)

The pictures of the patient (Figs. 5 and 6) show what can be ac-

Fig. 5.—Retouched photographs of patient, showing wire fixation from vitallium screws to headcap appliance.

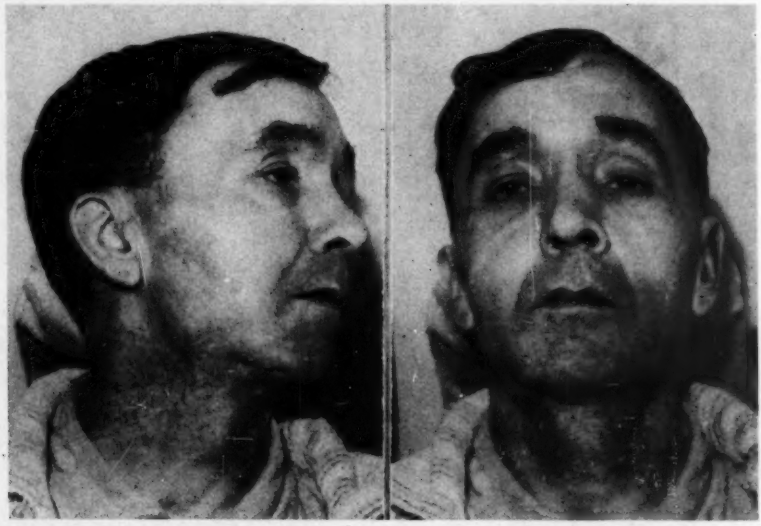

Fig. 6.—Patient (Fig. 5) after mandibular slip and bone replacement graft.

complished with wire stabilization from vitallium screws in the fragments to wire hook attachments on a headcap. The patient had a fracture and an

osteomyelitis of six months' duration when we first saw him. About three-fourths of the body of the mandible was missing on admittance. The scar had been caused by an incision for drainage and the exfoliation of sequestra. A mandibular slip and bone replacement graft was accomplished by the use of the screws and traction. The absence of scars at the site of the screws is to be noted.

SUMMARY

In those cases in which arch wires, bands and splints cannot be used in the treatment of fractures, the employment of vitallium screws inserted extra-orally, either alone or in conjunction with the dural strap, or the Bigelow alinement bar, will have satisfactory results with very minor surgical procedures.*

115 Station Hospital.

*The technics and appliances described were developed while the author was employed by the Veterans' Administration at Portland, Ore. The photographs and patients are from the same institution.

"Anesthetic Sense."—As regards general anesthesia, we have been burdened too much with a formula. It is all very well to know about the stages of anesthesia; the induction stage, the excitement stage, the surgical stage, and the danger zone, with all their various strata and differentiations. We are ready to adjust this gadget and that one according to the chart we have pictured in our mind's eye. We are eternally looking for these illusive lines of demarcation between the stages about which we have studied so much. We measure the relative lengths of inspiration and expiration, and try to note whether the eye oscillates eccentrically or horizontally. In short, we are too mechanical and precise, and we escape the true "anesthetic sense." . . . For the work that we have undertaken, we should develop that acuteness of hearing and vision that will immediately record any departure from the normal while the patient is under the influence of the gas. It is a peculiar perception that comes from experience only and an intelligent interpretation of evidence. This evidence is not arbitrary in its indications. Each patient is a law unto himself. The "anesthetic sense" will allow us a wide latitude within the limits of perfect safety.—W. J. McLaughlin, in *J. A. D. A.*, 1933.

UMI

CYSTS OF THE MAXILLA AND MANDIBLE
DIAGNOSIS AND TREATMENT

KENNETH W. PENHALE, D.D.S., M.D., Chicago, Ill.

According to Potts,[1] Scultet, in 1654, was the first man to describe cysts of the jaw. About 200 years later, Fouchard associated these cysts with the teeth. Paget,[2] in 1854, was the first to give us the term "dentigerous cyst," meaning "dental follicle containing fluid and one or more teeth" (Fig. 1).

CLASSIFICATION

Broca,[3] in 1869, was the first to point out that the cause of cysts was a developmental disturbance of the tooth follicle. Magitot,[4] in 1878, stated that, "every spontaneous cyst of the jaw is essentially and exclusively of dental origin." It was Magitot who made definite distinctions among the cysts arising from the epithelium of the peridental membrane, which he called *kystes périostiques* (root cysts).

Root cysts (Fig. 2) are by far the most common cysts found on x-ray examination. Rosenstein[5] reviewed a series of 416 cases. In 394, he called the lesion a root cyst, and in thirteen a follicular cyst. Nine were not differentiated. The etiology of root cysts was well described by Bunting,[6] who says,

> Dental root cysts develop from periapical granulomata of long standing. A dense connective tissue is formed about the periphery of the granulomatous area which tends to shut off the blood supply of the granulation tissue. Degenerative processes follow in certain areas of the granuloma. Wherever these occur, the epithelium proliferates to surround and to encapsulate these foci. Further degeneration and liquefaction follow, producing a cystic cavity in the center of the granuloma about which is formed a dense fibrous wall.

A granuloma (Fig. 3) at the apex of a non-vital tooth is not uncommon. In the absence of inflammation, granulomas are most easily diagnosed by x-ray examination and perhaps only by this method. It is difficult to differentiate large granulomas and small root cysts. One characteristic roentgenographic finding at the apex of the pulpless tooth is an erosion about part or all of the apex of the tooth in question. Small granulomas and a small area of granulation tissue should also be differentiated, although this is not always possible. A granuloma usually has a clearly defined area of lessened density (radiolucent), whereas granulation tissue (Fig. 4) does not have so clearly defined a peripheral margin as does a cyst. Granulation tissue may be the forerunner of a root cyst, especially when it contains epithelial cells. For this reason, ordinary granulomas should be removed

in toto at the time of the extraction, but this procedure is contraindicated in the presence of clinical signs and symptoms of an acute infection about the apex or apices of the tooth in question (Fig. 5). Curettement in the presence of an infection may do more harm than allowing the granuloma to remain, especially since many heal even without surgical interference.

Follicular cyst is so called because it is thought by many to have a direct connection with the tooth follicle and to have been produced by a disturbance of this follicle. Bloch-Jorgensen,[7] of Denmark, states that a follicular cyst in children is always associated with a pulpless deciduous tooth or the remnants of one. He believes that the primary cause of the development of such cysts must be infection from a pulpless deciduous tooth. The extension of the complaint to the follicle of the tooth must be considered a secondary feature. His bacteriologic studies of seven cases revealed

Fig. 1.—Dentigerous cyst in man aged 55 who had been wearing partial plates for several years. The cyst cavity was opened and allowed to partially fill in before the unerupted third molar and the cyst lining were removed.

Streptococcus hemolyticus in six and the nonhemolytic streptococcus in one. A case of similar etiology is demonstrated in Figure 6.

Osteitis fibrosa cystica (Fig. 7) is a rare cystic condition of the maxilla and mandible. When small, these cysts appear much like a residual root cyst and are difficult to differentiate roentgenologically. There appear to be two types of such cysts: one a generalized form; the other a local form occurring only in one bone. The etiology of such cysts is usually unknown, although it is thought that they are the result of a disturbance in parathyroid metabolism. They appear as round or oval radiolucent areas and usually have as definite a periphery as one usually sees in an x-ray film at the

periphery of an ordinary cyst area. These cavities do not have an epithelial lining, but merely contain fluid and fibrous connective tissue.

According to the microscopic report on the material from the anterior cavity in Figure 7, left:

Edematous fibrillar stroma [was] composed of cells having a blue elongated to oval vesicular nucleus and a pale pink fibrillar cytoplasm. There was no regular fasicular formation; the cells were irregularly arranged about small irregular bone spicules, in places surrounded by osteoclasts. There were several

Fig. 2.—Root cyst treated by immediate enucleation and extraction of central incisor.

Fig. 3.—Granuloma at apex of mesial root of lower molar (left) and x-ray appearance of root after removal. The granuloma, which measured 6 by 4 by 4 mm., was intact. Microscopic examination revealed a thick fibrous tissue densely infiltrated with round and plasma cells having a cavity in its center, the lining of which was made up of flattened fibrous tissue cells.

small vacant spaces or cysts with a flattened lining. There were also a moderate number of veins and lymph channels which were moderately distended. This microscopic picture was compatible with a diagnosis of osteitis fibrosa cystica.

In the maxilla, there are two types of cysts which are also confusing. First is the median maxillary cyst (Fig. 8), which appears in the midline in the region of the anterior palatine foramen. When small, these cysts have to be differentiated from an abnormally large anterior palatine foramen, somewhat triangular, whereas a median line cyst appears as an oval cavity when viewed in the x-ray film. Median line cysts were first described, in 1914, by Meyer,[8] who demonstrated these on cross-section of cadaver specimens. These cysts have no connection with the anterior teeth, nor are they thought to be infectious in their origin. They occur in the intermaxillary suture line of the maxillary bone a few centimeters distally from the gingivae of the central incisor teeth. The treatment of such cysts is complete surgical removal. It is not difficult to diagnose or to treat large cysts of such nature, especially in edentulous cases (Fig. 9).

Large cysts of the maxilla (Fig. 10), when adjacent to the maxillary

Figure 4.

Figure 5.

Fig. 4.—Root cyst of apex of upper first bicuspid. There were areas of bone destruction at the apex of the cuspid and the lingual root of the first molar suggestive of granuloma or granulation tissue.

Fig. 5.—Granuloma at apex of lower incisor. The condition was regarded when first seen as an acute abscess. The tooth was extracted.

sinus, often present a difficult problem in treatment. A radiolucent area of a low maxillary sinus may simulate that of a root cyst (Fig. 11). In a dental x-ray film, a radiopaque line about an upper pulpless molar is often mistaken for a cyst instead of being identified as an abnormal antral septum (Fig. 12). When small cysts are situated anteriorly from or in the floor of the maxillary sinus, their identification is much easier than when they are in the posterior area of the antrum, as in a follicular cyst from an unerupted upper third molar (Fig. 13). Clinical symptoms, usually of pressure in such cases, may be present. If the only evidence one has of such a

cyst is roentgenographic, the findings should be confirmed after the outer wall of the supposed cyst cavity has been opened by packing sterile iodoform gauze moistened with lipiodol solution in the suspected cyst cavity. If, on x-ray examination, one finds a radiopaque cavity evidenced by the lipiodol solution adjacent to a normal radiolucent area of the antrum, he can be almost certain that he is dealing with a cyst. If, on the other hand, the saturated gauze tends to follow the peripheral outline of the antrum in its entirety, probably no cyst will be found. If a large cyst is accurately identified and demonstrated in this manner, the treatment should be well

Fig. 6.—Left, destructive process in lower first molar region fourteen months after extraction of molar. The radiopaque shadows are two small pieces of enamel. No epithelial lining was found. Microscopic examination of the contents revealed chronic inflammation. Right, appearance of molar region two months after surgical interference.

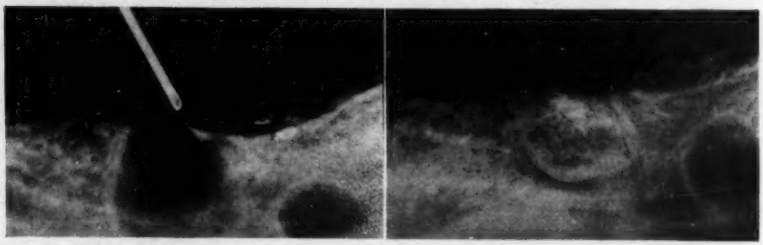

Fig. 7.—Left, osteitis fibrosa cystica (March 31, 1936). The x-rays reveal two cystic areas in the body of the edentulous mandible. Right, same area four years later. There is evidence of bone repair in the area previously treated. The distal cavity showed enlargement. There was no roentgenographic evidence of similar phenomena in any other bone in the body. The patient is now under treatment for carcinoma of the breast.

planned. Owing to the poor regenerative power of bone in such locations, it is probably not wise to remove the cyst wall as it presents itself when the cyst is very large. These cysts are best treated through a Caldwell-Luc opening high in the canine fossa. The epithelial lining of the cyst cavity covering the bone should be left intact. One can usually join the cyst cavity

with that of the maxillary sinus. Owing to the persistent drainage, a permanent opening should be made under the inferior turbinate before the Caldwell-Luc incision is closed. Antral irrigation through the nasal opening

Fig. 8.—Median line cyst.

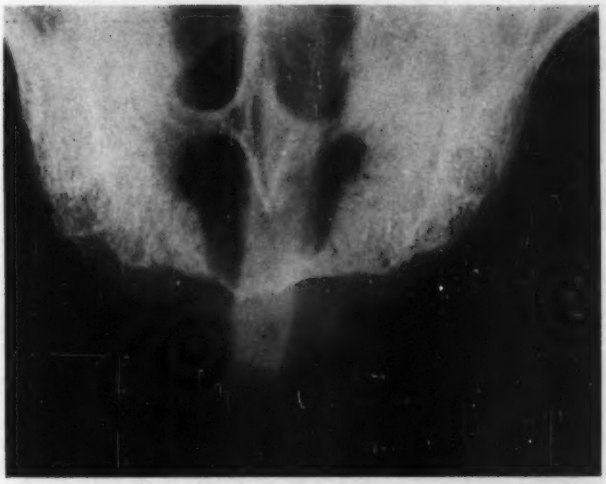

Fig. 9.—Large median line cyst of maxilla.

should be instituted and continued for an indefinite period after such an operation.

Of recent years, there have been reported a few cases of traumatic cyst

(Fig. 14), appearing usually in the mandible. They are roentgenologically, at least, true cysts and are usually in the body of the mandible, close to or encroaching upon the lower border of the jaw. Some authors believe that they originate from remnants of Meckel's cartilage. The only case that I ever observed was in a young male of the yellow race who gave no history of injury or any other history that I could understand. It is obvious that

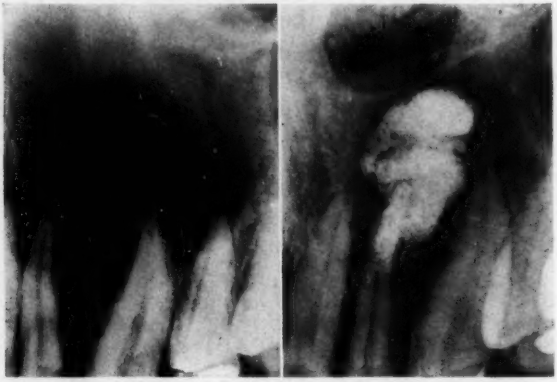

Fig. 10.—Left (July 31, 1942), large root cyst in anterior region of left maxilla. The hard palate on the left side had been destroyed. Drainage was established on the lingual surface distally from the lateral incisor. An obturator was worn for three months to prevent a nasal twang. Right (January 5, 1943), appearance six months later. The radiopaque shadow is made by sterile gauze moistened with lipiodol and packed firmly in the cavity, making evident the extent of bone repair and the present size of the cyst cavity. The epithelial lining has not been removed to date.

Fig. 11.—Shadow in floor of maxillary sinus suggestive of root cyst. X-ray films taken at various angles disproved this possibility.

I did not recommend surgery in this case, but merely an x-ray examination every year, "at Christmas time." Whether these patients should be operated on is a question. If the cyst increases in size over a period of years,

my decision would be in the affirmative, to guard against pathologic fracture.

Of all the cysts that occur in the maxilla or mandible, none is so rare

Fig. 12.—Shadow about apex of upper first molar suggestive of root cyst. X-ray films taken at various angles disproved this possibility.

Fig. 13.—Follicular cyst of upper unerupted third molar which had been extracted. Packing of sterile gauze moistened with lipiodol solution through the third molar socket revealed the extent of the cyst. The maxillary sinus outline is also visualized.

or so important as adamantinoma (Fig. 15), a peculiar entity thought to develop from the remains of an enamel organ. Robinson[9] seriously ques-

tions whether enamel has even been found in the mandible or maxilla in cases of similar microscopic configuration. These are also called multilocular cysts, and, of recent date, have been called ameloblastomas. The latter term, being more descriptive, should be used even in preference to the word adamantinoma. Strange as it may seem, such cysts or tumors have been found in the tibia and the pituitary gland where no enamel organ exists. The first case of such a tumor of the tibia was reported by Fischer,[10] in 1913. Since that date, fourteen cases have been reported in a summary by Dockerty and Meyerding,[11] in 1942.

Clinical diagnosis of such tumors or cysts, when found in the mandible, is most difficult, especially if they are small. When they are large, one usually finds no parchment-like outer wall as is found in large dentigerous cysts. When observed, the outer walls are usually bulging, and, on palpation, appear firm as if filled with a semihard material rather than with

Fig. 14.—Traumatic cyst of mandible. No history of injury could be ascertained.

fluid. Microscopic examinations are the only positive means of identification. Treatment of such tumors has also been a question. Curettage with the cautery has in certain cases inhibited their growth.[12] In the tibia, amputation was instituted after recurrences in the majority of cases treated conservatively in their early stages.[11]

In the maxilla and mandible, resection is the only positive means of cure.[13] Curettage, followed by use of the cautery, may be instituted when the lesion is small. The patient is kept under periodical observation. Many cases of cures have been reported with similar treatment.

The x-rays and radium play little part in the treatment of these tumors as they do not appear to be radiosensitive (Fig. 16).

DIAGNOSIS

It is usually considered that the x-rays are the only means at our disposal of making a diagnosis of cyst of the maxilla or mandible. This is only partially true. In general, the diagnosis of any swelling is based on history, physical findings, x-ray interpretation and microscopic examination. Early, it is important to differentiate tumors from inflammatory swelling. If a cyst becomes infected, one may find an inflammatory swelling of short duration. Thus, a history should always be taken. There may be no abnormal physical findings in the case of a small dormant cyst.

When such cysts are small, the only means of arriving at a tentative diagnosis is the x-ray film. When there is a small radiolucent area about a

Fig. 15.—Ameloblastoma (adamantinoma) of body of left side of mandible. An acrylic splint was cemented to place to prevent a pathologic fracture before surgical curettage. The patient came in for treatment two months after the onset of the symptoms. The radiopaque masses are cement.

pulpless tooth, one of three possibilities should be considered: an area of granulation tissue, a granuloma or a dental cyst.

A giant-cell tumor (Fig. 17) in bone (maxilla) may, in its early stages, present a radiolucent area, but in no way resembles a cyst. A carcinoma of the mandible is very rare, and, in some instances, resembles a large cyst (Fig. 18). Only on careful interpretation of the roentgen findings can one arrive at a diagnosis, and the diagnosis should always be confirmed by a microscopic examination.

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Giant-cell tumors in the mandible may also be interpreted as cysts (Fig. 19). On surgical investigation, in these cases, one does not find the characteristic cavity filled with fluid, but a cavity filled with organized connective tissue grossly resembling that of an organized blood clot.

As they enlarge, dental cysts in the region of the symphysis of the mandible usually retain their characteristic radiolucent appearance, but vary in outline. In some locations, the outline is very irregular (Fig. 20). They usually retain their characteristic appearance of having a radiopaque line about the periphery. This line is thought to be the result of osteoblastic deposition.

Surgically, the diagnosis of a cyst is based on two findings: cystic straw-

Fig. 16.—Large recurrent ameloblastoma (adamantinoma) of body and ramus of right side of mandible.

colored fluid and an epithelial lining, which surrounds the entire cavity. In case of doubt, all material removed from such a cavity should be submitted to a pathologist for microscopic examination.

TREATMENT

There are but two widely used methods of treatment: the open method advocated by Partsch, and immediate enucleation of the cyst sac.

In my opinion, immediate complete enucleation is not a method of choice

except in cysts a centimeter or less in diameter. In large cysts, the open method is still the method of choice (Fig. 21).

Carl Partsch, of Breslau, Germany, made an original contribution in 1892. For some unknown reason, men who have written on this subject usually discuss Partsch's method as incising the mucous membrane over the cyst; removing the outer bony wall; opening into the cyst sac; sutur-

Fig. 17.—Giant-cell tumor of maxilla in region of upper right cuspid socket.

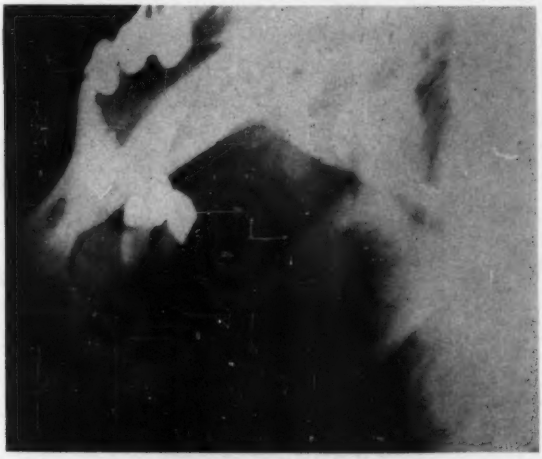

Fig. 18.—Extensive carcinoma of mandible; primary lesion (buccal sulcus).

ing the mucous membrane of the mouth with that of the epithelial lining of the cyst; packing with gauze first, and then keeping the cavity open by means of gauze, compound or a prosthetic core.

The original article ("Cysts of Jaw"), as written by Partsch fifty years

ago, appears in *Deutsche Monatsschrift für Zahnheilkunde* (German Monthly *Review of Dental Therapeutics)*.[14] From an interpretation of this article, I find the procedure given there differs from our present understanding of Partsch's treatment. As the English translation of this original article is interesting and worthy of review, it should be included.

I quote from this article, page 287:

The simplest and safest method leading to a cure is based on the anatomic fact that the inner wall of the cyst is lined with epithelium, which is analogous with the oral epithelium; in other words is oral epithelium. The growing together of the two epithelia can thus be anticipated, the cyst being then converted into a small recess of the oral cavity. I remove just enough of the anterior wall of the cyst to make immediate closure of the wound impossible. After the wound edges have granulated, their cicatrization is accomplished by both the cyst and the oral epithelium. The two epithelial masses meet at the edge of the incision, blend with each other and thus draw the rest of the cystic cavity into the mouth.

Fig. 19.—Giant-cell tumor of body of left side of mandible in woman aged 35. The diagnosis was confirmed by microscopic examination.

For excision of the cyst wall, I use strong Cooper's scissors with pointed blades, or preferably, especially where the bony plate is still quite firm, pointed bone-cutting scissors. After one of the blades has been thrust into the cyst, the

instrument cuts with one smooth, sharp stroke an adequately large piece of the cyst wall, including the bone and oral mucous membrane. The resulting hemorrhage is insignificant and can readily be controlled by a tamponade. Should a large blood vessel be severed, it can be grasped within the mucosa and ligated. If this is not feasible, the inner wall of the cyst may be sutured to the mucous membrane flap along the wound edge. This may be necessary when the cyst is situated higher up in the anterior wall of the jaw, where the soft tissue covering is thicker.

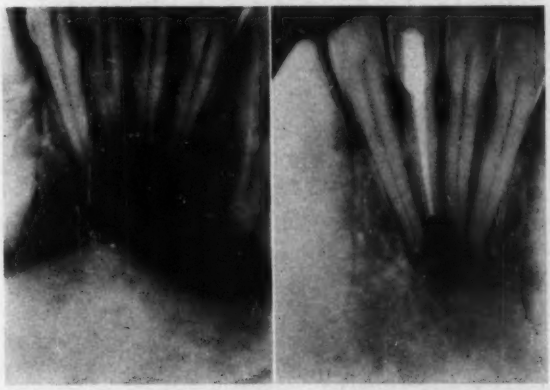

Fig. 20.—Left, large root cyst involving apices of lower anterior teeth and extending from cuspid to cuspid. The case was treated by the open method. Right, same case one year later. The right lateral incisor has been treated and its apex removed. It has been impossible to obtain further x-ray pictures.

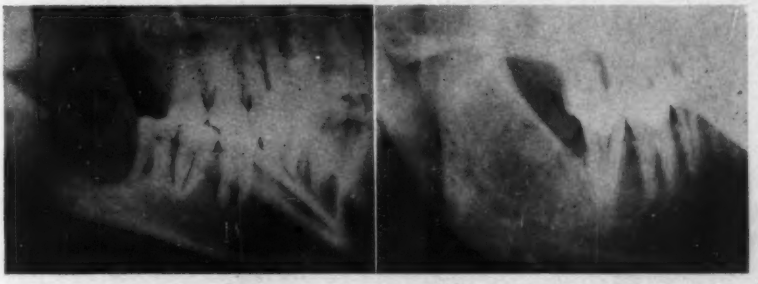

Fig. 21.—Left, indeterminate cyst in ramus of mandible of youth aged 20. Right, same case after extraction of lower third molar and drainage of cyst cavity March 10, 1942. Rapid regeneration of bone is evident, six weeks after beginning of treatment.

After hemostasis, Partsch removes the contents of the cyst by irrigation with a sterile physiologic sodium chloride solution or a diluted antiseptic and packs the opening of the cyst with an iodoform gauze tampon. Tight packing is to be avoided, since the pressure counteracts the natural ten-

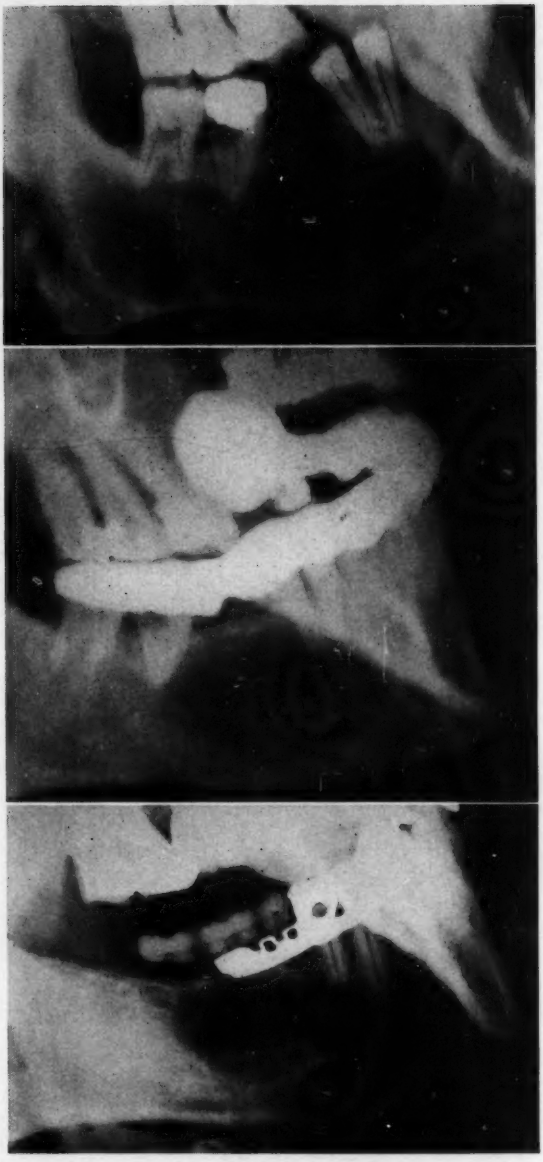

Fig. 22.—Above, extensive root cyst involving body of mandible. Center, metal splint applied to all lower teeth to prevent pathologic fracture. The cyst was treated by the open method. Below, appearance after removal of splint and extraction of molars. The patient was wearing a temporary lower partial plate, with no discomfort, awaiting further bone repair before removal of the epithelial lining.

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dency of the cyst to shrink. The pack is left for three to five days, during which time any sign of irritation or any foul odor is controlled by frequent irrigation of the mouth with an antiseptic mouth wash. After removal of the gauze pack, it can be noted that granulation of the wound had already begun. The packing is continued only until cicatrization of the wound edge has taken place. Thereafter, the cavity is left alone, except for removal of food particles with a spray of lukewarm water. As a rule, within six to eight weeks, the cavity is reduced to a small fissure. Only very large cavities require a longer time for healing.

The disadvantages of complete dissection of the cyst wall from the bone are, according to Partsch, the resulting large wound surface, the consequently increased possibility of infection, the slow healing by granulation and the danger of perforation into the antrum in the case of large maxillary cysts. He believes that partial or total resection of the maxilla is an un-

Fig. 23.—Left, large follicular cyst involving body and ramus of mandible. Right, appearance after removal of epithelial lining of ramus, August 17, 1942, after two years of continuous adequate drainage intra-orally.

necessary and a mutilating method of treatment of cysts. In his experience, cysts as large as 5 cm. in diameter have healed by shrinkage, without inconvenience to the patient. Radical operations are advocated only when parts of the cyst wall show malignant degeneration.

On the basis of wide experience, Partsch recommends his procedure as the method of choice in the treatment of radicular cysts. It is easily accomplished and it is the least disagreeable method for the patient and one that assures the best results.

In 1924, additional writings appeared in a text written by Partsch, *Handbuch der Zahnheilkunde* ("Textbook of Science of Dental Therapeutics").[15] On page 302, the operation is again described, in the main, as he described it in 1892.

In this text, Partsch makes many interesting comments. He states that the special protection of the cyst cavity by insertion of a prosthetic appliance, as advised by Brandt and Weiser, is unnecessary. Partsch states also that placing of obturators in the open cyst cavity is actually detrimental, since they hinder shrinking of the cyst. Partsch does mention that the covering of the cyst opening, as pointed out by Hesse, may be indicated when the cyst opening is so large that a distinct nasal twang is produced during speech.

Partsch states that the method proposed by Mosetig-Moorhof, consisting of inserting an iodoform plug in the cavity and then suturing, is impractical. Partsch sutured the two epithelial linings only when there was hemorrhage and when the cyst occurred high in the maxilla.

The foregoing description and conclusions by Partsch are of general

Fig. 24.—Case shown in Figure 23; November 13, 1942. The second molar was to be extracted and the epithelial lining to be removed from body of mandible at an early date.

interest to the clinician of today. The treatment is self-explanatory, and although first described in 1892 and again in 1924, it is, in general, true today.

In addition to the two methods, that is complete enucleation and the open method of Partsch, there is a possible third method, a combination of the two procedures, in which the cyst cavity is first opened and drained and later the epithelial lining is removed. This has been advocated. A wide U-shaped incision might be suggested instead of a longitudinal elliptical incision. The mucous membrane flap thus created is turned into the cyst cavity by means of a sterile iodoform gauze pack, which also prevents bleeding. Continuous gauze packs, compound, vulcanite or acrylic cores are

used only when absolutely necessary. However, if gauze or a compound core is left out, one may encounter the problem of maintaining the cyst opening until some regeneration has taken place. In these instances, it is advisable to remove, by surgical means, that part of the mucous membrane which has filled in, closing this cyst opening. It will be noted that after this has been done once or twice, the opening will often remain for a considerably greater length of time. To prevent a possible pathologic fracture in cases of a large cyst of the body of the mandible, a metal or an

Fig. 25.—Above: Large cyst of body of mandible of about twenty-five years' duration. A faded x-ray film dated 1918 revealed the same cyst, which was of about one half the present size. The patient refused treatment at that time because he had been told that the lesion was a tumor. Below: Occlusal view of cyst area.

acrylic splint might be suggested (Fig. 22). Fractures have occurred in such cases.

Often, when large cysts of the maxilla or mandible are under treatment by the open method of Partsch, healing may progress rapidly at first, but, later, progress becomes slow, In these cases, it is noted that the epithelium of the cyst cavity becomes very thick and fibrous, which perhaps hinders

Nature's efforts at repair. Such lesions are the more common cysts of the ramus and body of the jaw (Figs. 23 and 24).

In the majority of dental cysts over a centimeter in diameter, especially if close to the labial and buccal surfaces, there is much less pain or surgical reaction if the cyst is first opened and is kept open for a short time by whatever means is deemed advisable. Later, when the opening is closed, or nearly so, the epithelial lining can be enucleated and a direct closure be made. In some cases, recovery may be as rapid as in immediate enucleation, and pain and swelling become negligible (Fig. 25).

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FRACTURE OF THE EDENTULOUS MANDIBLE

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THE casting of the United States in the rôle of a belligerent nation has caused a renewal of interest in the subject of fracture of the facial bones. Coordinated knowledge of anatomy, physiology, orthopedics and surgery is basically essential to those committed to this phase of maxillofacial surgery. The inadequately trained, in assuming the responsibility of treatment, bring upon themselves anxiety and grief, and to the patient unnecessary suffering and distress. Traumatic lesions involving the edentulous mandible constitute, from the viewpoint of control, so distinct a phase of injury of the maxillary bones as to warrant special consideration. Owing to the absence of teeth, the fundamental methods of fixation, as devised by Gilmer and currently employed in complete or modified form, have no application in the management of fractures of this nature. Rather must the approach to the problem of immobilization more clearly simulate orthopedic procedures utilized in the handling of injuries to the long bones.

The symptoms peculiar to these particular mandibular fractures, as a rule, conform to a more or less general pattern. Usually, the patient has passed the middle span of life. The injury is frequently bilateral and probably there is extensive displacement. Facial distortion is marked. Invariably, there is peripheral anesthesia of the inferior alveolar nerve. In contrast to similar injury involving the jaw possessing teeth, where there is a break in the mucous membrane or communication exists with the vascular peridental membrane, fractures of the edentulous mandible are commonly of the simple type. To this characteristic and to the freedom from apical infection may be attributed the diminished susceptibility to a complicating osteomyelitis. Obviously, clinical diagnosis should always be supplemented by an adequate roentgenographic survey. In the absence of bodily injuries of a more serious nature, treatment should be undertaken as soon as feasible. Delay is prone to increase the inflammatory reaction, to further muscular contraction and to encourage the growth of fibrous tissue at the site of injury, thus creating conditions inimical to the normal processes of repair.

In an analysis of the methods available for reduction, the choice should be based upon three desiderata: 1. Since continuity of the fractured bone is the objective, the type of end-result obtainable is of prime importance. 2. The reaction and comfort of the patient must be given due consideration. 3. The use of the simplest procedure compatible with success is desirable.

The method longest in favor utilizes the Gunning splint, which bears the

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name of its originator. The popularity of this procedure can be traced to its use and the attendant publicity during the Civil War when William Seward, Secretary of State in Lincoln's cabinet, was attacked by a would-be assassin. Its design, briefly, consists in adaptation of vulcanite splints to the maxillary and mandibular ridges and the union of the splints by pencil-width posts of like material. After it is in position in the mouth, a head bandage is applied to force the lower jaw into the vault of the splint with a view to approximating and immobilizing the parts. That this goal is difficult of achievement when any marked degree of displacement exists is easily capable of clinical demonstration. In addition, painful bruising of

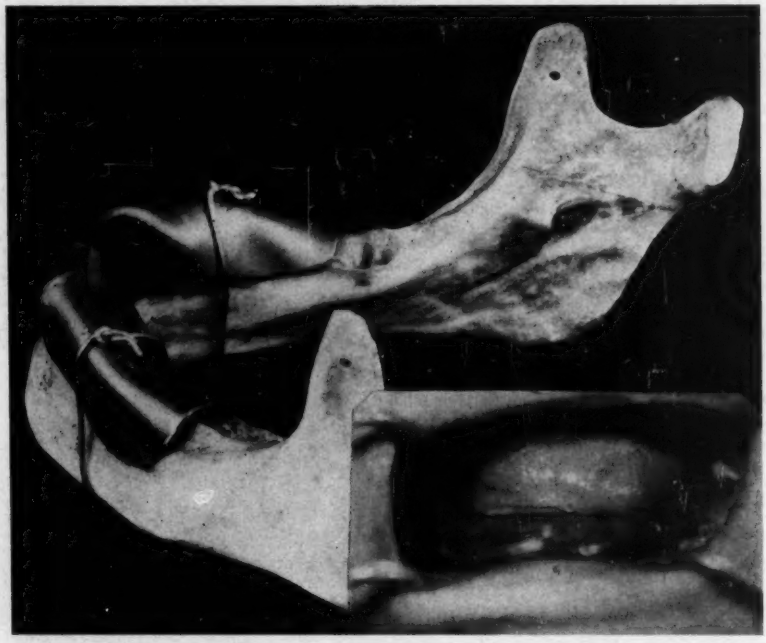

Fig. 1.—Circumferential method of immobilization. Wires pass around both splint and mandible. Inset: Bilateral fractures reduced by circumferential method; splint and wires seen within oral cavity.

the oral tissues is often a natural consequence. The Gunning method can be considered as reaching its highest point of efficiency when limited to those simpler cases in which muscular imbalance is at a minimum.

The circumferential method (Figs. 1 and 2), devised by G. V. Black, long lay unnoticed in the archives of traumatic surgery. Its very practical usefulness is attested by the frequency with which it has been employed

during the past decade. Highly satisfactory results obtained in a large series of cases evidence its clinical importance.[1] This method of immobilization necessitates the use of the patient's lower denture or a specially constructed vulcanite or metal splint. First, incisions are made on each side of the jaw through the skin at the inferior border. Through these incisions, an antrum trocar and cannula are inserted. This instrument enters the mouth, piercing the tissues on both the labial and the lingual aspect of the jaw. A fine wire is passed through the cannula and over the splint, to emerge at the skin incision. Tightening the wires has the effect of reducing the parts to normal position. The ends may be made to emerge either in the mouth or below the jaw.[2] The circumferential wires are well tolerated and may be retained for several weeks, the skin incisions most often closing without suppuration.

The third method that lends itself to the treatment of the fractured edentulous jaw is the direct wiring of one fragment to the other. (Fig. 3.) The general assumption has been that the approach should be confined to

Fig. 2.—Left: Fracture of mandible before immobilization; ramus in forward and elevated position. Right: Reduction by circumferential method.

the external tissues. The failure to employ the intra-oral avenue, even though such procedure was easy, has been based on the inherent, yet erroneous, belief that bone infection would inevitably follow. As aptly expressed by the late John B. Murphy, the progressive clinician casts aside all bias, and looks first and foremost to end-results. In evaluating the intra-oral and extra-oral procedures, the true perspective should not be clouded by the unsatisfactory experiences associated with the use of the Lane plate, an obsolete practice today.

The choice of approach must be determined by a careful study of the particular case. In general, the farther back the fracture line is and the narrower the oral orifice, the greater the advantages of outside penetration. Emphasis has previously been placed on the facility of the intra-oral method.[3] Fundamentally, the procedure is similar, regardless of the method.

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An orthopedic drill is used to perforate the bone at points distant from the fracture line. If cicatricial tissue is present, its removal and the freshening of the edges of the bones are essential. Insertion of pliable silver or brass wire in the apertures previously fashioned is followed by tightening and twisting of the wire, thus bringing the parts into apposition. Provision for ample drainage should always be made.

In orthopedic surgery, in the successful employment of external appliances embodying pins and screws for insertion in bone, there has been born the suggestion that fractures of the mandible might be amenable to similar treatment. There appeared in the initial issue of the JOURNAL OF ORAL SURGERY, an excellent review of the literature on this mode of treatment as applied to fractures of the jaws, by the Editor and collaborators.[4] As regards traumatic injury of the edentulous mandible without loss of bone, the use of skeletal fixation appears to present no advantages not obtainable by the methods of circumferential reduction and direct wiring of the fragments. Failure to meet the premises outlined earlier in this paper, plus the

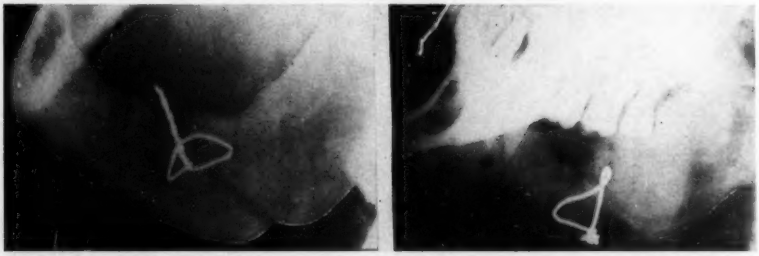

Fig. 3.—Left: Direct wiring of fractured mandible (intra-oral method). Right: Direct wiring of fractured mandible (extra-oral method).

absence of the necessary clinical evidence, precludes the substitution of these newer ideas for procedures long found dependable, simple and effective.

POSTOPERATIVE CARE

The supervision of the case subsequently to operation is simple. When the circumferential method is used, occasional tightening of the wires may be necessary. Regardless of the procedure employed, adjustment of the ends of the wires to prevent undue impingement on the soft tissues will tend to reduce discomfort. To promote a hygienic condition, periodic cleansing of the oral cavity with a mild iodine preparation is advisable. The use of Dobell's solution as a mouth wash constitutes a supplementary measure which the patient should religiously utilize. Because of the freedom of the temporomandibular joint, the diet presents no unusual problem. Obviously, any inflammatory process reaching the stage of suppuration should be handled by incision and drainage.

SUMMARY

The management of fracture of the edentulous mandible entails the use of methods unlike those indicated when a complement of teeth is present. In this paper are briefly discussed three accepted procedures, the first of which is limited in its usefulness, the latter two offering a broad field of applicability. Clinical experience appears to warrant the more frequent use of the intra-oral approach when the method of direct wiring is employed.

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Extraction Objectives.—It is most interesting to review dental literature having to do with the removal of teeth and to note the different objectives which were considered most important by the various writers of the day. Primitive surgery for the removal of teeth was most concerned with the immediate relief of pain. With the development of more efficient mechanical aids, rapid extraction was considered important, until, with the advent of anesthetics, there began a period of discussion on operative technic. The use of the roentgen rays induced a progressive series of articles dealing first with retained roots and unerupted teeth, and then, on the recognition of the systemic significance of pathologic areas, come discussions regarding treatment of cysts, residual areas, etc. It was at this time that true surgery for the removal of teeth made its appearance, with interest centering mainly in the preparation of the dental ridges for the support and retention of dentures. Following this came the surgical removal of teeth, the design of mucoperiosteal flaps, the question of bone resection, curettage and various methods of instrumentation. Postoperative disturbances, pain, trismus and trauma came in for a great deal of discussion, which continues.—Wilton W. Cogswell, in *J. A. D. A.*, 1933.

NON-UNION IN FRACTURE OF THE MANDIBLE, WITH REPORT OF A CASE

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Baltimore, Md.

NON-UNION in the case of fracture of the mandible is uncommon, even though many of these fractures are compound, with a break in the oral mucous membrane, which affords a means of ingress of bacteria. It is also noted that while infection delays union, or may be the cause of non-union, cases are frequently complicated by osteomyelitis and formation of a sequestrum, union occurring long before the bone infection clears up. The causes of non-union are: separation of the line of fracture due to retention of descended roots of teeth; late reduction of fracture; extensive loss of bone from severe injury, and infection followed by osteomyelitis and necrosis.

In our practice, we have, from time to time, had a few cases of non-union of the mandible. These have been treated by various procedures, such as wiring, plating and inlay grafts (technically a difficult procedure) plus dental splinting. The results on the whole were not satisfactory. For this reason, it is our opinion that non-union of the mandible should be treated as non-union of any of the long bones. In three cases treated in this manner, the results have been good, and it is the purpose of this paper to report one of them. Onlay grafts were used, being held in place by silver wire, and further immobilization obtained by dental splints.

In a brief review of the literature, especially before the first World War, there apparently was a belief that the mandible was peculiar, in that successful grafting can rarely be obtained as in grafting of the long bones. It was also believed that the mandible was very intolerant of foreign bodies of any kind and that attempts to fix a free graft by wire, pegs or a plate almost invariably led to failure. Dovetailing of the graft between the fragments or inlaying of them in the fragments was also frequently unsuccessful. It was believed that further fixation of the fragments by dental splints led to absorption of the graft, if carried out before the operation or before the wound had healed. After many experiments, Billington and Round came to the conclusion at this time that no attempt should be made to fix the graft in place and that the dental splints should not be applied until approximately three weeks after application of the graft.

During the first World War, considerable experience was gained in the treatment of fracture of the mandible, especially when there was a loss of

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a large amount of bone; and, from this vast experience, many of the misconceptions just noted have been clarified. In the treatment of these cases, the graft was taken from the ilium and the fragments were overlapped at each end about 1 inch. To hold the graft in place, the soft tissue was sewn closely over it.

While possibly applying to filling large defects of the mandible, the above-mentioned principles do not necessarily hold true in grafting of the mandible for non-union of fractures when there is only a small defect. It is also our opinion that fixation of the graft plus the use of dental splints for immobilization is essential and that close cooperation between the surgeon and the dentist is of the utmost importance. Under favorable conditions, the mandible will probably tolerate foreign material better than is generally believed. This conception is borne out by Waldron, who states that, in his

Fig. 1.—Cast splint on lower teeth with posterior saddle extension holding down alveolar process ridge on posterior fragment.

experience with maxillofacial surgery in World War I, all splints were constructed and applied before operation and bone grafting.

The types of grafts used in treatment of defects of the mandible or non-union of fractures are: pedicle grafts from the mandible, grafts from the ilium, osteoperiosteal grafts from the tibia and full thickness grafts from the tibia. Rib bone is too soft and does not develop strength to equal that of the mandible. The pedicle graft from the mandible and the osteoperiosteal graft from the tibia do not give uniformly satisfactory results. The grafts from the ilium can be shaped readily, are thick and strong and cause no anxiety about their nutrition. They are particularly adaptable when there

is a large defect present. Full thickness grafts from the tibia are brittle and cannot be readily shaped or beveled to fit when there is a large gap to be filled. They do accommodate themselves readily as onlay grafts in non-union of the mandible when there is only a small defect present. In using these grafts, one also adds to the immobilization.

REPORT OF CASE

History.—D. D., white, a merchant seaman, aged 70, but appearing to be 55, had had syphilis in 1905 and diabetes in 1935. He was waylaid and beaten April 5, 1939, and was admitted to the hospital three days later.

Examination.—The weight was 156 pounds; height 5 feet 6¾ inches; blood pressure, systolic 130, diastolic 82. The examination was negative except for swelling of the left side of the mandible. The lower left second molar was fractured. The Kline and the Eagle test (for syphilis) were negative. The blood sugar was 300 mg. per hundred cubic centimeters.

Fig. 2.—Eyelet units placed on upper teeth for subsequent insertion of wires to secure teeth in occlusion.

Treatment.—The fractured tooth was extracted and the teeth were wired in occlusion. Daily oral asepsis was maintained. The wiring was changed April 26. May 9, the mandible became swollen and painful and required incision and drainage. At this time, chemotherapy was instituted. June 19, a sequestrum was removed.

The wires were removed on July 27 and the patient was discharged August 3 to the outpatient department. During his entire stay in the hospital, the diabetes was controlled with diet and protamine zinc insulin.

The patient was readmitted October 10, 1940 for treatment of non-union. At this time, a lower impression was taken with hydrocolloidal material. The

posterior fragment at the site of fracture was held posteriorly in normal position while the impression was taken. The upper impression was also taken and casts were mounted in occlusion.

A cast splint (90 per cent silver, 10 per cent copper) was constructed and fitted over the lower teeth with a saddle over the alveolar ridge at the site of fracture and extending posteriorly, thus holding the posterior fragment in normal relation. (Fig. 1.) The upper teeth were held in occlusion by a splint.

On the day before the operation, the splint was cemented to position and the eyelet units were placed on both the upper and the lower teeth. At this time, the intermaxillary tie wires were not inserted, this being done for transfixation the day following the operation. (Fig. 2.)

The above-mentioned appliance was retained from October 8, 1940, until March 7, 1941, when it was removed. At short intervals, and after the appliance had been in place about three months, the intermaxillary tie wires were

Fig. 3.—Complete union of graft from tibia.

removed, being replaced after a few days. At no time was there evidence of trismus on removal of the intermaxillary tie wires. The patient was discharged May 3.

A check-up in December revealed good results. (Fig. 3.)

PRELIMINARY PREPARATION

It is essential that there be no sepsis in the field of operation, and at least ten or twelve months should be allowed for all infection to subside before an attempt at operative intervention. Unless this precaution is taken, a latent infection may flare up. It is also essential that there be no sinus tracts into the mouth. A dental splint should be worn for a while before the operation, to make sure that splinting will be comfortable and satisfactory.

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OPERATION

An incision from 1½ to 2 inches in length is made under the border of the mandible through the skin and subcutaneous tissue down to the bone. The soft tissue is freed along the inner surface of the mandible, the operator being careful not to make an opening in the floor of the mouth. It may be necessary to free some of the attachments of the internal pterygoid muscle to assure apposition for the graft. (Fig. 4.) The fracture line is then identified and thoroughly cleaned of all fibrous tissue and the bone fragments are freshened on each side. In this procedure, great care is used not to penetrate the gum margin and enter the mouth, as this would defeat the purpose of the operation. Small drill holes are made through the mandible on each side of the fracture. All bleeding is controlled and a warm sponge is left over the incision while the full thickness graft is taken from the tibia.

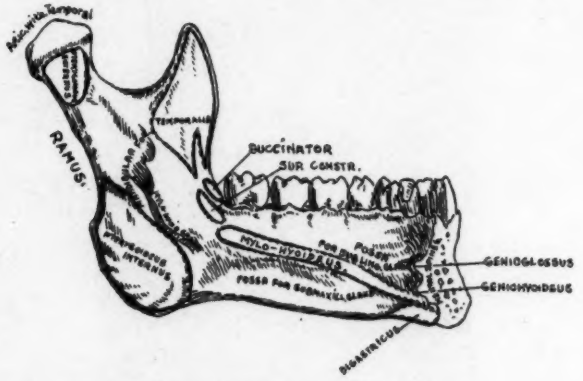

Fig. 4.—Mandible, internal surface, side view. (Gray's Anatomy.)

Small drill holes are placed in the tibial graft before removal, to coincide with the holes already made in the mandible. The graft is then removed with an electric saw. After removal, the graft is wired in place with silver wire, along with the inner surface of the mandible. A portion of the endosteum is removed from the graft and some of it is taken from the tibia and placed between the bone fragments. Both wounds are closed snugly with plain catgut in the subcutaneous tissue and dermal or fine silk in the skin. The usual postoperative care is instituted. The patient is watched closely until he recovers from the anesthesia and until it is certain that he will not strike the mandible or break the splint.

The following day, after there is no danger of nausea and vomiting, the

intermaxillary tie wires are inserted. These are kept in place constantly, and the patient is kept on a highly nourishing liquid diet. After a period of approximately three months, the intermaxillary tie wires are removed and motion is allowed in the mandible joint. It is usually necessary to maintain the dental splint and intermaxillary wiring for approximately six months.

SUMMARY

A successful outcome depends on waiting until all sepsis is eliminated from the field of operation and fixation of fragments by intra-oral and extra-oral methods can be accomplished. This means close coordination between the surgeon and the dentist, the employment of a rigid aseptic technic and the avoidance of infection by an opening into the buccal cavity at the time of operation.

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Oral Cancer.—Such symptoms as localized pain, a loose tooth, abscess and swelling of the lower jaw, in the vast majority of cases may have nothing to do with cancer, but one must think of cancer, and must institute those diagnostic surveys that will detect its presence—roentgen-ray films of the teeth and of the upper and lower jaw; coverslip examinations of the mouth, not only for Vincent's infection, but also for other pyogenic organisms; blood tests for syphilis; blood counts for the presence of anemia and leukemia, and studies to determine the possibility of scurvy. An oral survey must be as comprehensive as a medical survey. According to our present-day conception of thorough physical examination, one is incomplete without the other. I believe, on the evidence available today, that the control of cancer of the mouth is the problem of the dental profession, because the dentist is the first to see those enlightened persons who come early for treatment. —Bloodgood, in *J.A.D.A.*, 1933.

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ASPHYXIA IN ORAL SURGERY

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WHILE anoxemia has always been a problem of the utmost importance in oral surgery, its significance as a major medical problem was largely overlooked until about ten years ago.

It can be said that an editorial appearing in the *American Journal of Surgery* for December 1932 entitled "Asphyxia a Professional Disgrace" marked the beginning of a campaign that resulted in the professional groups of the country becoming concerned about asphyxia.

Briefly, the high spots of this campaign can be noted as follows:

A full-day conference on asphyxia, held at the New York Academy of Medicine, May 24, 1933.

A second conference, lasting two days, in which appeared speakers representing the United States Army, the United States Navy, the United States Public Health, the industries, the utilities, insurance and university groups, held at the Hotel Biltmore, February 19 and 20, 1934.

The prompt approval of the New York County Medical Society, the New York State Medical Society and the American Medical Association of the aims and purposes of the Society for the Prevention of Asphyxial Death responsible for the new movement.

A full report of the two conferences on asphyxia by editorial and by thirty-two columns of abstracts in the *Journal of the American Medical Association.*

The subsidization of fourteen booths on asphyxia by the Scientific Section of the American Medical Association meeting at Atlantic City, in 1935.

The appointment of a committee on asphyxia by the Board of Trustees of the American Medical Association, in 1936.

The subsequent report of the Committee on Asphyxia, in 1937.

Direction of attention to the problem of asphyxia neonatorum by a questionnaire and subsequent correspondence carried on with the heads of departments of obstetrics in every university in the United States and Canada, in 1938-1939.

Contact with stratoliner development, beginning in 1936.

The establishment of a department of pneumatology at the New York World's Fair, in 1939.

The continuous presence of the Surgeon General of the United States Army, the United States Navy and the United States Public Health Service on, and, more recently, the addition of the Director of the Veterans' Facilities

Read at a regular monthly conference of the New York Institute of Clinical Oral Pathology, October 28, 1940.

to, the advisory board of the Society for the Prevention of Asphyxial Death has signalized the significance of the movement. Today, at war, we face the major problem of asphyxia.

The field of oral surgery presents frequent hazards and occasionally fatal asphyxial complications.

It may be pointed out that in spite of the relative frequency of asphyxia from obstructive causes during the maintenance of anesthesia in oral surgery, the existence of asphyxia before and after operation should be appreciated. For this reason, it is important to consider the four types of asphyxia that the oral surgeon may encounter.

1. Anoxic anoxia, in which the alveolar oxygen presented to the capillaries for absorption is deficient, as in atmosphere of low oxygen concentration or when respiratory obstruction occurs.

2. Anemic anoxia, in which the blood carrying capacity of oxygen is reduced, as in carbon monoxide poisoning or hemorrhage.

3. Stagnant anoxia, in which the activity of the circulation is reduced, as in shock or cardiac decompensation.

4. Histotoxic anoxia, in which the tissue cells are poisoned by some chemical and unable to utilize the oxygen brought to them by the circulation, as in hydrocyanic poisoning.

Bearing in mind the types of asphyxia stated above, we may note their occurrence before, during or after operation.

Before the patient is anesthetized, the stagnant anoxia of chronic cardiac decompensation, the anemic anoxia of a low hemoglobin or the histotoxic anoxia of chemotherapy should be observed. While this chronic anoxia may not appear serious in the ambulatory case, it forms a basis upon which serious anoxic, obstructive asphyxia may readily supervene.

During the induction of the anesthesia, more particularly in the plethoric patient, anoxic anoxia is commonly seen. Indeed it has been thought by some that such anoxia may be ignored. Recent findings relative to the effects of protracted anoxia upon the nerve tissues, more particularly the tissues of the higher centers, suggest the hazards involved in such technic. Furthermore, postanesthetic nausea and vomiting follow closely the curve of protracted anoxemia regardless of the anesthetic agent employed. Parallel effects are common in mountain climbing and in high altitude flying.

Avoidance of anoxic anoxia during induction turns upon the skill of the anesthetist. Means are available by which such anoxia can be relieved, by the use of suction or the pharyngeal tube, or by positional changes.

During the maintenance of anesthesia, the full range of anoxic causes may be faced. Chemotherapy, with its histotoxic anoxia, anemic anoxia from hemorrhage, anoxic anoxia from improper mixtures of the anesthetic and stagnant anoxia as a result of protracted operation and obstructive anoxia may require attention.

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The vicious cycle of anoxic anoxia resulting in stagnant anoxia from cardiac failure is readily discernible.

There is available for common use in oral surgery a blanket approach by which anoxemia can be satisfactorily overcome during the operative period or the maintenance of anesthesia.

This blanket approach and protection consists in the establishment of a completely unobstructed airway that is not affected by the operative procedure. Such protection completely eliminates obstructive anoxia and provides a direct means whereby anoxia resulting from anemia, histotoxic effects and anoxic effects may be prevented.

Absolutely free ventilation of the respiratory airway, plus a high oxygen concentration in the anesthetic agent, guarantees the widest margin of safety.

By what mechanical means can this condition be secured? There is but one safe procedure and that is the routine use of the endotracheal tube.

Surgical technic and asepsis demand intubation under direct vision. A sterile tube, carefully checked as to safety of diameter and postoperative effects by hundreds of operators in thousands of routine bronchoscopies, is passed directly into the glottis.

Blind intranasal intubation offers the objections of tracheal contamination by nasal secretion, trauma to the glottis by forceful intubation, postoperative nasal hemorrhage and irritation through the presence of the tube in the nose. The technical ease of this procedure, however, and the elimination of laryngoscopy has seemed to popularize it in some circles.

In mechanical convenience and safety, the use of the endotracheal tube cannot be compared to the so-called intrapharyngeal insufflation technic, in which anesthetic vapor is blown into the pharynx behind a mouth pack. It is obvious that this pharyngeal technic does not eliminate the danger of anoxic anoxia, nor does it provide safe means of combating anemic anoxia, histotoxic anoxia and a supervening stagnant anoxia, from cardiac failure.

It is the duty of every anesthetist to be fully acquainted with laryngoscopy and intubation. The treatment of the terminal stage of asphyxia or flaccidity by intubation will be referred to at the conclusion of this paper.

The danger of anoxia does not disappear when administration of the anesthetic has ceased. When premedication by avertin (tribromethyl alcohol) or the barbiturates has been employed; when hemorrhage into the pharynx occurs, or when the pressure of bandages or the position of the head embarrasses the respiration, asphyxia may occur with a fatal outcome.

Should stagnant, anemic or histotoxic anoxia be present or suspected before operation, premedication should be eliminated altogether or used with small dosage. After the operation, the patient should be placed upon the side. The knee next the table should be bent, both hands should be placed in front of the patient and the head should be extended. Experi-

enced nursing care should be available until the reflexes have returned. Frequent swallowing suggests concealed hemorrhage, and vomiting of blood confirms this suspicion. It is my practice in oral surgical operations to employ premedication with caution; to induce anesthesia with nitrous oxide-oxygen, and to maintain it by the use of ether vapor and the free use of oxygen, and to enter the stage of recovery at such time that the reflexes shall have returned, before postoperative nursing care begins.

Whenever unconsciousness is artificially produced by the use of anesthetic agents or it is likely to occur accidentally, facilities for mechanical resuscitation should be available.

The prevention of asphyxial death turns upon the following conditions: the stage of asphyxia; the physical signs; the indications for treatment, and the technic and apparatus required.

The stages of asphyxia are as follows:

Depression: The patient is unconscious, but can be roused. The vital functions are unimpaired.

Spasiticity: The patient is unconscious and cannot be roused. The vital functions are embarrassed.

Flaccidity: The patient is unconscious and cannot be roused. The vital functions are seriously interfered with or in abeyance.

The physical signs of these stages are constant, regardless of the cause of asphyxia.

The Stage of Depression: The patient is in a stuporous or semiconscious state. He may be roused by slapping the face, applying friction to the lip, etc., but usually relapses after stimulation. The reflexes are active and respirations shallow and quiet. The pulse is regular, but may be depressed or stimulated. The patient may retch or vomit and may move the extremities.

The Stage of Spasticity: The patient is completely unconscious and cannot be roused. He is cyanosed or pallid, the condition depending on the circulation. Breathing is obstructed and there is a tendency to masseteric spasm. Vomiting and bleeding from the mouth or nose are common. The eyes are injected. The skin is warm. The pharyngeal reflexes are active and extremities rigid. The circulation is sluggish or the bounding pulse of anoxemia is noted.

The Stage of Flaccidity: The patient is completely relaxed. The jaws separate without resistance. The pharyngeal reflexes are in abeyance. The skin is cold and clammy. The eyeballs are fixed, the reflexes absent. The laryngeal reflexes are sluggish or absent. The respiration is shallow and obstructed, or not demonstrable. The heart sounds may be inaudible. The patient is cyanosed or pallid.

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INDICATIONS FOR TREATMENT OF EACH STAGE; MECHANICAL APPARATUS REQUIRED

The Stage of Depression.—The condition suggests that treatment be directed to relieve exposure and shock rather than to the specific relief of the asphyxia. The patient should be given oxygen and carbon dioxide, because stimulation of the respiratory centers results automatically in an increase in the circulation rate. Heat should be applied to the extremities and to the body. The patient should be placed on the side and provision be made to care for nausea and vomiting. Hypodermic stimulation can be given to advantage. No fluid by mouth should be permitted. The apparatus necessary consists of (1) an inhaler with a bag near the face-piece; (2) facilities for rebreathing, and (3) an adequate supply of oxygen or oxygen-carbon dioxide.

The Stage of Spasticity.—The existing anoxemia must be handled promptly and aspiration of fluid or foreign matter into the trachea must be prevented. Respiratory obstruction from clenching of the teeth or interference of the tongue with the administration of oxygen should be relieved by the use of oxygen by nasal or oral tube, accompanied by the use of suction. Strenuous efforts to separate the teeth and to pull the tongue forward should be avoided, because adequate oxygen can be administered back of the obstruction by means of the nasal catheter or the nasal tube. If the patient is breathing freely, however, without signs of respiratory obstruction, oxygen can be given by an inhaler. The equipment required consists of (1) a pharyngeal tube; (2) a nasal catheter; (3) adequate suction facilities for use in the throat, and (4) oxygen and oxygen-carbon dioxide.

The Stage of Flaccidity.—Relaxation of the muscles of the airway and disappearance of the pharyngeal and laryngeal reflexes as elicited by suction and by use of an oral tube constitute positive indications for mouth-to-mouth insufflation, or, better and much more effective, suction laryngoscopy, intubation and endotracheal suction, followed by oxygen insufflation endotracheally for a period of five seconds, under pressure of 25 to 40 mm. of mercury. This treatment will maintain life by relieving the respiratory center and stimulating the Hering-Breuer reflex, provided there is a functioning circulation.

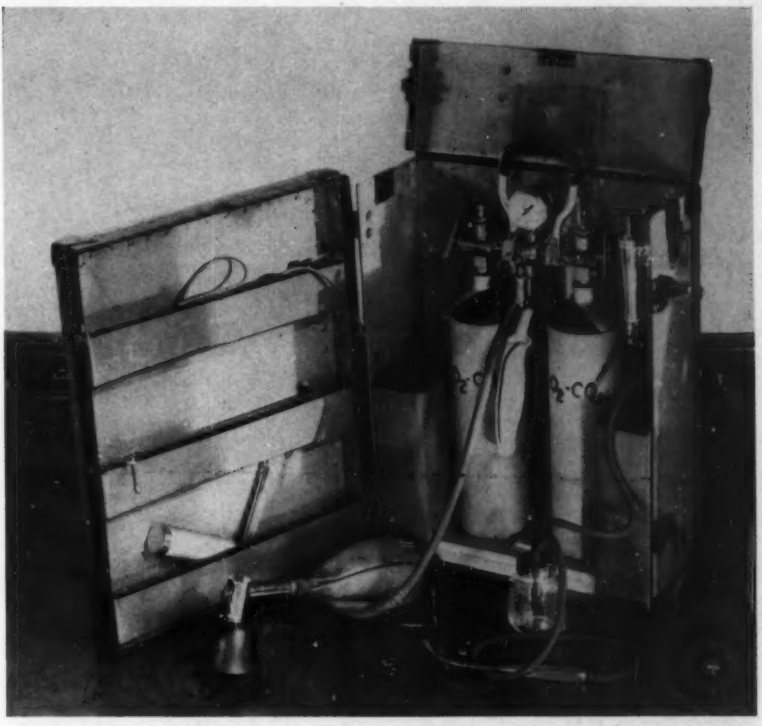
Coincidentally, with endotracheal insufflation, the patient should be given intracardiac injections of adrenalin, accompanied by intravenous administration of metrazol. The apparatus required consists of: (1) a laryngoscope; (2) intubation tubes; (3) endotracheal suction facilities; (4) apparatus for administering oxygen and oxygen-carbon dioxide; (5) a pressure manometer; (6) hypodermic solutions, with facilities for intracardiac injections, and (7) means for heating the body.

The so-called P. A. D. resuscitation assembly, prepared for the prevention

of asphyxial death and exhibited at the New York World's Fair, and providing facilities for the treatment of the three stages of asphyxia, is shown in the accompanying illustration.

However, any inhaler capable of supplying a flow of oxygen-carbon dioxide will relieve the depressed condition.

Any source of oxygen and carbon dioxide, preferably in a mixture of 90 per cent oxygen and 10 per cent carbon dioxide, under a pressure not exceeding 25 mm. of mercury, delivered through a catheter, size 16 or 18



So-called P. A. D. resuscitation assembly prepared for prevention of asphyxial death and providing facilities for treatment of three stages of asphyxia.

French, and accompanied by means for suction in the airway, will relieve spasticity. Any convenient laryngoscope and tube for endotracheal suction, intubation and endotracheal insufflation under measured intermittent pressure will provide modern medical resuscitation for the patient who may otherwise die.

38 East Sixty-First Street.

UMI

THE DENTIST AND THE BRONCHOSCOPE

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THE accidental lodgment of foreign bodies of dental origin in the upper air and food passages is often of vital concern to the dentist. Such objects may escape after extraction under general anesthesia, during instrumental treatment or as the result of poor fit or mechanical defects of dentures. In all of these cases, the dentist may play an initiating part, and he may at times find himself in an unpleasant legal dilemma. Such accidents are readily avoidable if the dentist appreciates the reasons for their occurrence and will take adequate precautions to avoid them. It is the purpose of this article to call the attention of the dental profession to the importance of this aspect of clinical dentistry and to suggest certain measures whereby accidental swallowing or aspiration of dental foreign bodies may be prevented.

Foreign bodies of dental origin may be appropriately divided into: (1) teeth or fragments thereof, (2) dental instruments or parts of them and (3) artificial dentures and such appliances as bridges, crowns and inlays. In the great majority of instances, lodgment of these objects in the lower air and food passages is accidental and not the result of any gross negligence or carelessness on the part of the dentist. Frequently, the patient is at fault, and through failure to have a defective or poorly fitting denture corrected, may experience its dislodgment during sleep, while eating or on suddenly laughing or coughing. Nevertheless, it is most often the dentist who has the opportunity to prevent such accidents before they result in distressing complications, often leading to serious disability and prolonged illness.

In a few cases, teeth may find lodgment, and most often in the bronchial tree. If a loosened tooth is accidentally aspirated during sleep or in moments of laughter or coughing during inspiration, the normal protective laryngeal reflexes are in abeyance, and the glottic opening is left unprotected. More often in my experience, such teeth or parts thereof gain entrance to the lower airways during extraction under general anesthesia and in the customary upright position when, for obvious reasons, the normal sensitivity of the laryngeal mucosa is blunted and the swallowing mechanism is obliterated. It is self evident that such loss of a tooth during extraction is essentially accidental, at times even unavoidable. It should, however, at once be evident to the dental surgeon that the offending tooth cannot be produced as a *corpus delicti,* and therefore that some search for it is in order. When a considerable number of teeth require extraction at one sitting, the risk of loss of an individual tooth is much greater. Evidence of aspiration, which

may be apparent even before the patient recovers from the anesthesia, may consist of abnormal cyanosis or spasmodic cough. The assumption that any missing tooth has been swallowed and hence is safely in the gastrointestinal tract must never be indulged in, since, if erroneous, it may lead to a false sense of security, which will only serve to delay the correct diagnosis. One and only one procedure can be considered as nullifying any charge of negligence in the face of possible aspiration of such dental foreign bodies, and that is immediate and careful x-ray examination of the chest. To permit

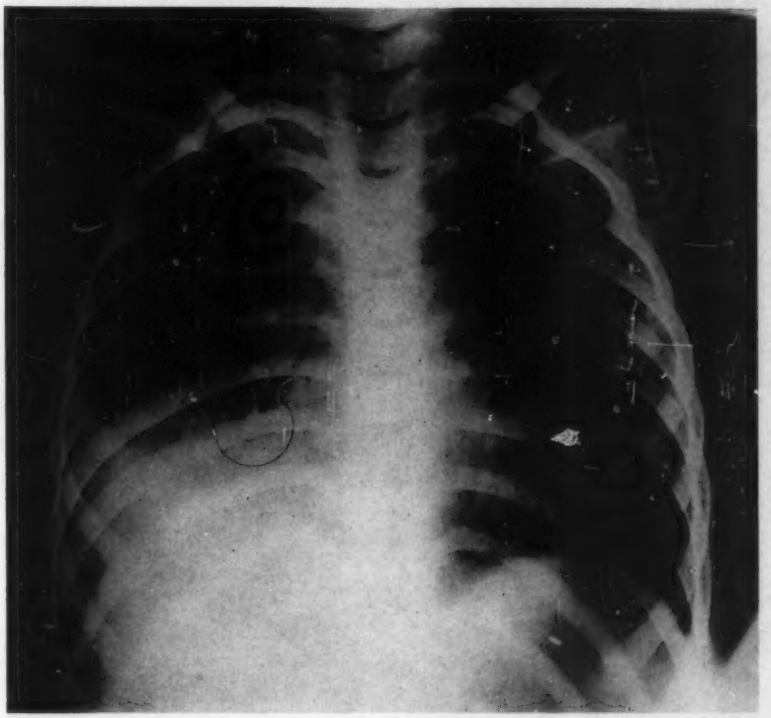

Fig. 1.—Roentgenogram of chest of 9-year-old girl, showing lodgment of tooth in lower bronchus following extraction.

patients who have undergone a recent extraction to complain of unexplained cough or to develop fever without this essential precaution is to risk not only the patient's future health, but also the dentist's reputation. If the missing tooth is not to be seen in the tracheobronchial tree and is subsequently passed naturally, nothing has been lost and invaluable information has been gained.

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If, by chance, such roentgen-ray examination shows the tooth in the lung field, disconcerting as this may be to patient and dentist alike, again the indications for procedure are crystal clear. Immediate removal of the foreign body by bronchoscopy is imperative. Futile hope that it will be spontaneously expelled should be immediately abandoned, however much one may wish to avoid the additional operative measures. The details of these and the instrumental problems attending them will be of no concern to the dental profession and are inappropriate to this discussion. Suffice it to say that the technical difficulties of extraction are in inverse ratio to

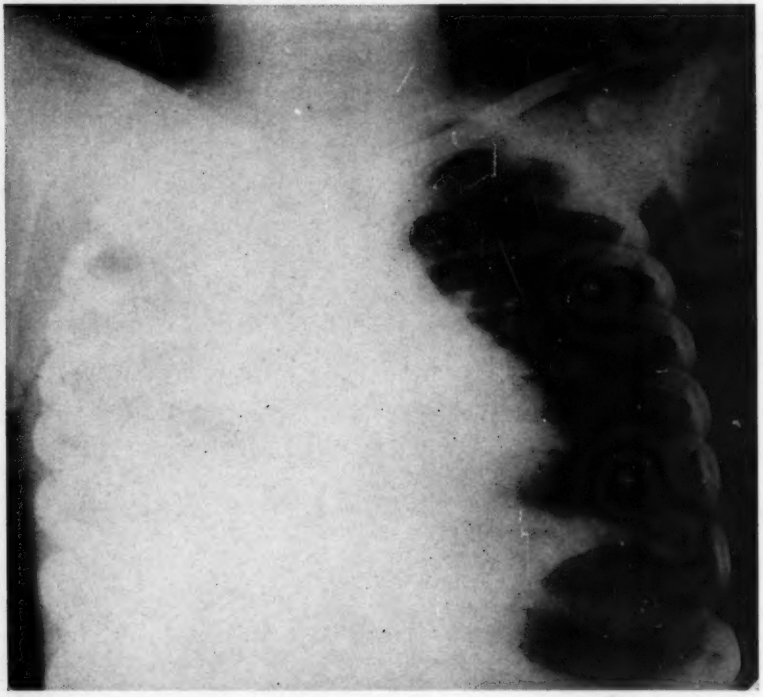

Fig. 2.—Appearance of lung in Figure 1, after removal of tooth; showing pulmonary atelectasis, lung abscess and empyema.

the length of sojourn of the foreign body, and the sooner removal is undertaken, the happier will be the end-result.

Few foreign bodies remaining in the tracheobronchial tree are more apt to cause increasingly damaging pulmonary suppuration than the human tooth. With many varieties of metallic and vegetal foreign bodies, even after prolonged sojourn and the development of peripheral suppuration,

complete recovery and restoration of normal pulmonary function will take place after removal of the foreign body. With a tooth, there appears to be a far greater tendency to initiate a pulmonary infection, particularly if removal is delayed beyond a period of one or two weeks. Teeth in themselves, particularly if partially decayed, may harbor virulent organisms, which, once implanted in the bronchial mucosa, may propagate infection into the weakly resistant pulmonary tissues, with disastrous results. For this reason, it is imperative that the lodgment of any missing tooth be confirmed or excluded and immediate steps be taken for its removal.

Occasionally, teeth may be dislodged, not spontaneously or by extraction,

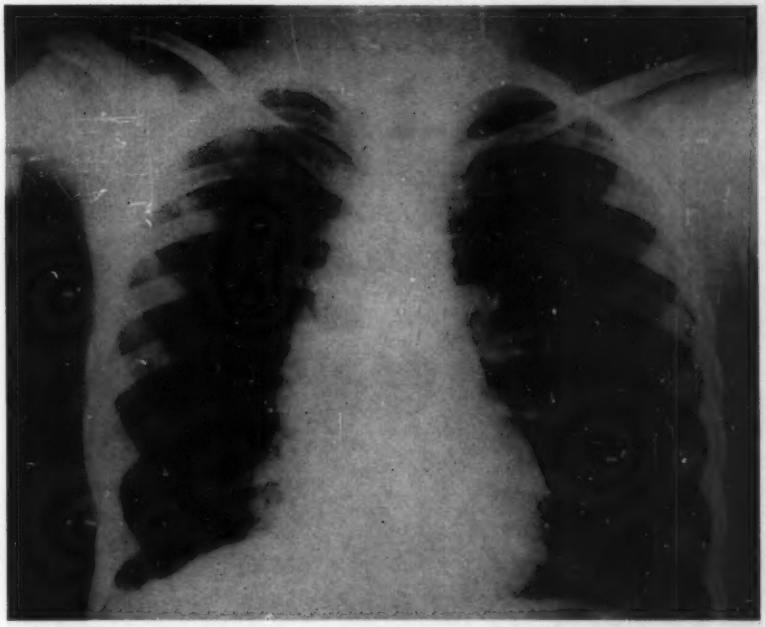

Fig. 3.—Appearance after subsidence of acute infection; showing chronic bronchiectasis, requiring subsequent lobectomy.

but as the result of instrumentation during operations on the mouth. Here, there is clearly no dental responsibility, but prompt removal is equally essential, and it has occasionally happened that a dentist, unaware as to why a molar is missing, has replaced it, not realizing that it lay unsuspected in the lung. A dental canal reamer may now and then slip into the larynx, and, while less provocative of infection than a tooth, usually lodges in a less accessible place, with increased difficulty of removal. With such a

foreign body, obvious loss should lead to immediate investigation and determination as to whether it has slipped into the bronchus.

The presence of dental objects in the esophagus, if they are of small size, is of far less serious import than in the lung. The classic obstructive foreign body of dental origin is a part of an artificial denture, with or without one or more attached teeth. Such dentures often have sharp retention clasps or hooks, and if they become imbedded in the delicate mucosa of the esophagus, serious damage may result, unless they are skilfully disengaged by esophagoscopy. Such dentures usually come to rest in the esophagus during sleep, intoxication or some sudden accident which dislodges them from their proper position. Immediate difficulty in swallowing is the classic symptom. X-ray films of such dentures may be extraordinarily deceptive, since the bulk of the plate may not be radiopaque and the fragments of visible metal may give no clue as to the true nature of the size and shape of the object, the esophagoscopist thus being deprived of valuable information as to the mechanical problem involved in removal.

Much prevention and prophylactic work rests with the dentist in stressing to patients the importance of prompt attention to loosened teeth, fillings and inlays and poorly fitting artificial dentures. If in the occasional unavoidable accident during extractions, any dental foreign body escapes, it should be promptly sought for by complete roentgen-ray examination and its removal undertaken as soon as possible by bronchoscopic measures. Thus will be avoided the unhappy sequelae of delayed recognition of such an accident and tardy measures in dealing with it.

319 Longwood Avenue.

Internist's Problem in Anesthesia.—The Personal Equation: There remains to be considered that intangible but nevertheless highly important factor in the success or failure of any surgical procedure, vis., the personal equation, which is so often overlooked, especially in institutional work. The "professional manner" of the anesthetist has been dealt with often and at great length and systems have been worked out to take care of the psychic element which, if not sufficiently considered, may nullify all our labors. It remains, however, for the internist who is intrusted with the preoperative preparation to see that the patient is in that frame of mind where he will approach the anesthetist with the serenity and calmness so essential to satisfactory results and will take the anesthetic without fear or excitement. For the accomplishment of this the internist's personal equation is quite as important as the patient's.—A. H. Waterman, in *Am. J. Surg.*, 1927.

SEVERE FACIAL INJURY OF UNUSUAL ETIOLOGY: REPORT OF CASE

L. Roy Johnston, D.M.D., Greenfield, Mass.

History.—C. F., a man aged 38 years, received a severe injury to head and face in an unusual manner while chopping down a tree November 3, 1941. Figure 1 shows the successive steps in the accident. Figure 2 is a picture of the tree, its size giving some idea of the force of the injury sustained by the patient when it suddenly snapped closed. (Fig. 1, below.) The accident occurred in an isolated district, and the chance passing of workers effected his release, it requiring an extreme effort to open the vise in which he was found. The patient, who was unconscious and had lost considerable blood, was removed to Brattleboro Memorial Hospital, Brattleboro, Vt., where he received first aid, and general care from J. R. Malloy, M.D. His condition was grave in the extreme. November 5, I was asked to examine the jaw fractures.

Examination.—The patient presented an appearance essentially as shown in Figure 3, above. While x-rays revealed a fracture of the skull at the external occipital protuberance, there were no neurologic or other symptoms of skull fracture beyond evidence of concussion. The patient was semiconscious. There were small lacerations, extensive contusions and extreme swelling with extravasation of blood in all tissues of the face and neck. There was a horizontal fracture of the maxillae at a high level with displacement downward, to the right, and backward. Previous to first aid, displacement backward was of such extent that the hard palate severely injured the tissues of the posterior pharyngeal wall. The fracture extended into both orbits, across the nose, involving the cribriform plate, and the zygomatic arch on both sides was fractured. The nose was flattened and depressed and the nostrils were filled with inspissated blood, which formed a curtain from the choanae to the pharyngeal wall, completely preventing nasal breathing. The crowns of the upper central incisors had been broken off (imbedded in the tree) and the lower central and lateral incisors with attached alveolar process were broken off, lying lingually.

Operation.—The broken teeth were removed and areas sutured. The nasal passages were cleared of clotted blood. An arch wire was attached to the upper teeth, and elastics from arch bar to wires, dropped from a plaster of Paris head-cap, held the jaw forward. Nothing more was done at this time because of extreme swelling and the general condition of the patient. Sulfa drugs were administered to prevent possible meningitis. November 9, the patient having shown marked improvement, a Stout cast sectional splint with Kingsley arms was attached to the maxilla, which was now brought into position. Figure 3, center, shows the patient's condition eleven days later. At this time, an intranasal splint (Fig. 4), a copy of Dr. Gerrie's[1] modification of the Watson-Williams splint, was placed in position by Dr. Noyes. I have used this splint in many cases with great success, and believe it to be much better than the

1. Gerrie, J. A.: *Canadian M. A. J.*, 30:37, January 1934.

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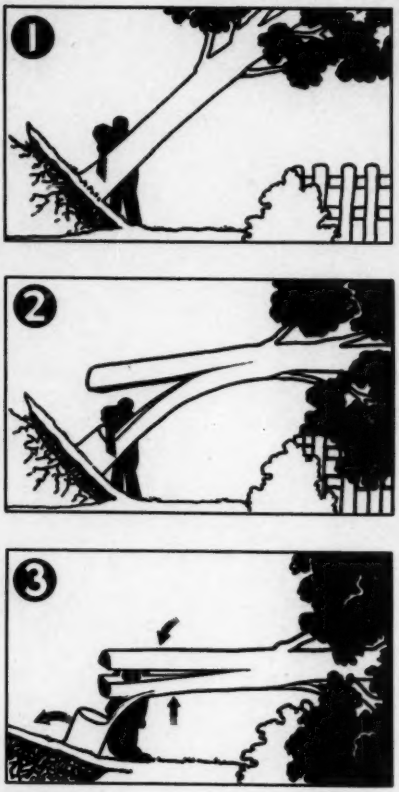

Fig. 1.—Succesive steps in accident.

Fig. 2.—Tree, showing vicelike aperture.

Fig. 3.—Above: Appearance of patient when first seen by author. Center: Condition eleven days later. Below: Appearance two weeks after removal of splint.

Figure 3

commonly used compressed cotton packs, which are obliterative. This splint allows nasal breathing, is more comfortable and provides excellent drainage, and there is less possibility of secondary infection of the sinuses. Figure 3, below, shows the patient two weeks after the removal of the splint. His only difficulty to date is loss of smell and a loss of taste in the palate, which has shown very little improvement in a year.

Fig. 4.—Intranasal splint, Gerrie modification of Watson-Williams splint.

Comment.—The occurrence of injuries like this one substantiate the observation of the National Safety Council that some of the most serious injuries, especially auto accidents of such severity as to prevent the patient's being moved, occur in areas far removed from urban centers. For this reason, the training of dentists in the handling of such cases should not be confined to those practicing in cities.

The Internist and Anesthesia.—In an emergency, a life-and-death condition, there may be no place for the internist, but in all operations of election there are ample time and opportunity to place the patient in the best possible condition to withstand the ordeal. In this there is definite work for the internist and there should be complete cooperation on his part with the surgeon and the anesthetist. The surgeon and the anesthetist must accept conditions as they find them; the internist can, in a large measure, shape conditions to meet the needs of the special occasion. Although he cannot make a hemophiliac or a lymphatic subject into a desirable surgical risk, his superior opportunities enable him to recognize these unfortunates in the beginning and to decide how, if at all, it will be possible for such subjects to undergo an operation.—A. H. Waterman, in *Am. J. Surg.*, 1927.

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Book Notices and Reviews

PRACTICAL ANESTHESIA FOR DENTAL AND ORAL SURGERY. Ed. 2. Harry M. Seldin, D.D.S., F.I.C.D., F.I.C.A. 560 pages, 217 engravings. Price $7. Philadelphia: Lea & Febiger, 1942.

INTERNAL MEDICINE IN DENTAL PRACTICE. Bernard I. Comroe, A.B., M.D., F.A.C.P.; Leon H. Collins, Jr., A.B., M.D., F.A.C.P. and Martin P. Crane, B.S., M.D. 521 pages; 76 engravings, 6 colored plates. Price $5.50 net. Philadelphia: Lea & Febiger.

CONGENITAL CLEFT LIP, CLEFT PALATE AND ASSOCIATED NASAL DEFORMITIES. Harold Stearns Vaughan, M.D., D.D.S., F.A.C.S. 198 pages; 259 engravings. Price $4. Philadelphia: Lea & Febiger, 1940.

OPERATIVE ORAL SURGERY. Leo Winter, D.D.S., M.D., F.A.C.D., F.A.C.S., Sc.D. (Hon.) LL.D. 1054 pages; 1211 illustrations. Price $12.50. St. Louis: C. V. Mosby Company, 1943.

MANUAL OF STANDARD PRACTICE OF PLASTIC AND MAXILLOFACIAL SURGERY. Military Surgical Manuals, National Research Council. Cloth. 432 pages. Price $5. Philadelphia: W. B. Saunders Co., 1942.

This volume is one of a series developed under the auspices of the Division of Medical Sciences of the National Research Council to furnish the medical departments of the United States Army and Navy with compact presentations of necessary information in the field of military surgery.

The purpose of this manual is directive. Haste in reconstructive surgery is made slowly. Time is the friend of both the surgeon and the patient. Judgment in planning and procedure derives not only from knowledge of sound basic principles, but also from experience.

The manual provides a standard of practice and accomplishment to aid the surgeon in the discharge of his duty to the injured. The patient has a right to expect that the best in modern practice will be employed to expedite recovery and restore function and appearance to the greatest attainable degree.

The assurance of such results depends on the intelligent cooperation, "teamwork," of all services concerned, from the time the patient leaves the field until he is discharged from the hopsital. It must result from avoidance of many past mistakes, a recognition of both the good and the bad in literature and practice.

This volume consists of three sections. Section I, 255 pages, covers the entire field of reconstructive surgery of the head and neck. It is an authentic practical guide for the care of the injured from the time he is taken up on the field until he is finally discharged from the hospital; the essentials of adequate treatment from the battalion aid station or equivalent, the collecting station, clearing or hospital station, evacuation hospital and general hospital.

The various types of injuries are described and illustrated and reconstruction is fully outlined. Well-established methods of restoring lost tissues by plastic surgical procedures are discussed in detail with special reference to the details

of operative and postoperative care. This section also includes skin grafting, ligation of arteries and the treatment of burns and shock and of fractures of the nose and malar bone.

Chapters III to IX inclusive present a complete discussion of the reconstructive surgery of the lips, cheeks, nose, eyelids, external ears, scalp, cranium and neck. Chapter X gives in detail the restoration of the hard palate and the premaxillary portion of alveolar process in the presence of an extensive loss, by means of an abdominal skin tube pedicle flap carried to the mouth by attachment to the wrist.

Section II (chapters XI and XII) (seventy-nine pages) covers maxillary surgery and includes the types and velocity of missiles in relation to the character of wounds of the face and jaws. First-aid and emergency treatment are presented in detail and include control of hemorrhage, maintenance of an adequate respiratory airway, the temporary approximate reduction and fixation of fragments and the responsibility of safe transportation from the combat zone to the rear. The treatment of fractures of the mandible is discussed at length and the methods are extensively illustrated. Complete summaries of treatment indicated at advanced hospitals and the definitive treatment at the general hospitals are presented. Chapter XII covers the regional consideration of fractures of the lower jaw and the special methods used to reduce displacements and maintain the fractured bone in correct approximation. Included is a discussion of external pin fixation appliances (skeletal fixation) and the nonsurgical treatment of trismus and ankylosis of the temporomandibular joint.

Malunion and non-union of fractures of the mandible and bone grafting for loss of substance of the mandible are well covered.

Fractures of the maxilla are presented somewhat briefly, but in a well-organized manner. The frequency of upper jaw fractures and the problems of reduction and maintenance of the maxilla justify a more detailed discussion of the treatment of these complicated fractures.

The construction of splints used in fracture treatment, for bone grafting and for the postoperative retention of skin grafts to replace lost oral mucous membrane, is presented in detail. The steps in the making of sectional splints of vulcanite, clear acrylic resin and cast silver and various attachments are well illustrated.

Section III, chapter XIII (thirty-four pages), maxillofacial prosthesis, presents in a very thorough manner the dentist's opportunity to be of great service in the prosthetic restoration of lost parts of the orbit, bone, cheeks, lips, ears, jaws and palate.

Section IV, chapter XIV (twelve pages), anesthetic technics, local anesthesia, covers the use of procaine and epinephrine in the care of injuries of the face and jaws. In chapter XV, general anesthesia (ten pages), preoperative medication, choice of anesthetics, including ether and nitrous oxide and intravenous anesthesia are discussed.

This manual is the most up to date, authoritative, best illustrated and most easily read text in the field of maxillofacial surgery. It should prove to be a valuable guide to those undertaking the treatment of war casualties and civilian injuries of the face and jaws.

C. W. WALDRON.

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TRAUMATIC SURGERY OF THE JAWS. Kurt H. Thoma, D.M.D., Professor of Oral Surgery and Brackett Professor of Oral Pathology, Harvard University. Cloth. 315 pages with 282 illustrations. Price $6. St. Louis: C. V. Mosby Co., 1942.

This text is designed to help the dentist in preparing himself to render first-aid and emergency treatment of jaw injuries and the dental student who may be called into the military service and should be prepared to render skilled service in maxillofacial surgery. The latest technics and methods of managing injuries of the jaws are presented.

The first chapter is devoted to first-aid, including the treatment of hemorrhage, shock, burns and respiratory obstruction. The clinical and roentgen examination of the patient, and records and history, with treatment planning and anesthetic technics, are thoroughly discussed.

The chapter devoted to fractures and traumatic injuries of the teeth and alveolar process is timely and the conservative treatment outlined is to be commended. The terms "simple compound" and "comminuted compound" fractures of teeth are somewhat confusing in the light of the long-accepted interpretation of the words "simple" and "compound" as applied to fractures of bone.

The fundamentals of the structure and musculature in relation to displacements and fracture treatment are well outlined, and many effective methods of fracture wiring and the application of arch bars or adaptable arch wire splints are illustrated step by step to enable the reader to put the method into actual practice. It is to be regretted that the Risdon twisted external arch wiring, one of the most useful methods for direct dental fixation or combined direct and intermaxillary fixation, is not discussed or illustrated. The same is true of the omission of the combination sectional splints made of metal, vulcanite or clear acrylic resin as developed by the dental corps of the U. S. Army.

The various methods employed for the reduction and control of posterior edentulous fragments are well outlined and illustrated.

The intral-oral skeletal fixation method is presented in detail, without, however, specific indication for its application in treatment of fractures of the edentulous mandible.

Three types of appliances used for extra-oral skeletal fixation of mandibular fractures are described in detail and well illustrated. The technic of the insertion of the pins or screws into the mandible and the adjustment of the appliances to reduce and fix the fragments is fully discussed. The indications for the use of this new method of treatment are enumerated. No opinion is expressed regarding the superiority of any of the appliances in the matter of adaptability, simplicity or security when applied. It is to be regretted that a description of the Converse-Waknitz-Roger Anderson splint, a very efficient and adaptable appliance, was not included in the text.

The chapter devoted to the consideration of fractures of the maxilla is well presented and adequately illustrated. The chapter on traumatic injuries of the condyle and mandibular joint is the outstanding section of the text, as it is complete in almost every particular. The applied anatomy of the temporomandibular joint is given and well illustrated. The diagnosis and treatment of functional and traumatic injuries of the joint, the meniscus; dislocations;

fractures, and fracture dislocations of the condylar process are discussed at length. The author considers the conservative treatment of displaced fractures of the condylar process effective in a considerable number of cases, particularly when the ramus is pulled down by interposing a gutta-percha block, a wedge or a splint posteriorly between the teeth. He also recommends manipulation and forcible depression of the ramus under general anesthesia as a means of permitting the condyle to assume a more nearly normal position. The author differs with a number of writers on this subject and advocates open operation in case of marked displacement and fracture dislocation. He describes and illustrates the operative procedures for removal of the meniscus and for open reduction of fractures of the condyle. The frank discussion of this controversy by the author should promote research in the ultimate functional results of union in various degrees of malposition resulting from the conservative handling of these injuries.

Deformities including ankylosis resulting from injuries of the jaws are discussed along with the operative procedures for their correction, as a worth while addition to this text.

This book is heartily recommended as a valuable addition to the literature.

SULFANILAMIDE AND RELATED COMPOUNDS IN GENERAL PRACTICE. Wesley W. Spink, M.D., F.A.C.P., Professor of Medicine, University of Minnesota School of Medicine. 374 pages. Price $3. Chicago: Year Book Publishers, 1942.

This completely revised second edition is evidence of the rapid development in the field of sulfonamide therapy and is based on the author's personal observation of more than a thousand patients on all services of the University of Minnesota Hospital. All of the available compounds are described and the dose and methods of administration are given in detail.

The history of the development and research in sulfanilamide and related compounds and the mode of action, absorption and excretion of these drugs is presented in a lucid and authoritative manner. All details regarding the determination of the concentration of the compounds in the blood and other body fluids are included.

Its usefulness in many types of infections and diseases is discussed fully from a bacteriologic and regional standpoint and the indications, contraindications and toxic manifestations are presented in a clear and inclusive manner.

The chapter devoted to the use of sulfonamide compounds in dentistry and oral surgery prepared by Carl T. Nelson is a timely and up-to-date presentation of this important and interesting subject. The bibliography of about 800 references is arranged conveniently by chapters relating to the text. Twenty-five references covering its use in dentistry and oral surgery are included.

This monograph is recommended as the outstanding text on this subject for the medical and the dental profession.

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Current Literature

INTERNAL WIRING FIXATION OF FACIAL FRACTURES. William Milton Adams.

Eighty-five cases of fracture of the maxilla are reported. Associated fractures of other facial bones were present in a great number of the patients, as follows: mandible, nineteen, xygoma, twenty-two, nasal bones, sixteen and skull, five. Facial lacerations were present in fifty cases. Infection and drainage occurred in five cases and there were three deaths from brain injury and meningitis. The author has found that extra-oral appliances and headcaps are complicated, cumbersome and uncomfortable to the patient and their application and adjustment are time consuming. After using these appliances for many years, he has, for the past two years, employed open reduction and fixation by wiring of the fractured parts to the neighboring unfractured bony structures in all but three cases wherein immobilization was required. He states that the method is applicable to virtually every type of fracture of the facial bones even when it is very extensive. A No. 25 or 26 stainless steel wire, a small drill and a dissecting instrument set are all that is required for internal wiring. The upper jaw is wired to the infra-orbital margin of the malar bone if there is no fracture and displacement of the malar bone.

In carrying out this method of open reduction and fixation of fractures of the facial bones, it is necessary to make an incision at only one of two sites: overlying the infra-orbital ridge, or at the lateral margin of the supra-orbital ridge, the choice depending on the bones involved. In the event of laceration over either of these areas, the wires can be inserted through the wound.

In a simple bilateral fracture of the maxilla, a small incision is made over the infra-orbital ridge on each side. A hole of sufficient size to accommodate a No. 25 or 26 stainless steel wire is bored through the infra-orbital ridge. The wire is then threaded through the opening and looped over the ridge, and both ends are passed together along the anterior wall of the antrum into the upper sulcus over the second molar teeth, where they are caught with a hemostat. One is surprised at the ease with which the wires are directed to the desired point of exit without the use of a guide. The fractured bone is then elevated to its normal position and the wires are drawn taut and fixed to one or more of the teeth. The use of the loop around the infra-orbital ridge is much simpler than tying the wire, and its subsequent removal is easy.

In edentulous patients, the wires are attached to the teeth of the denture or may be carried beneath the alveolar process ridges, to be joined in the midline of the palate over a wax mold applied to the upper jaw. In cases of combined fractures of the maxilla and malar bone, the wire is passed through the external portion of the supra-orbital margin of the frontal bone. The ends of the wires then pass behind the body of the malar bone to be attached to wiring or to arch bars or splints on the upper teeth. If there is any doubt regarding the fixation of the malar bone to the zygomatic process of the frontal bone, an additional hole is drilled in the malar bone to permit direct wiring in position with a small loop of wire.

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The wires are left in place for from three to nine weeks, the time depending on the location and type of fracture. They cause little or no discomfort and may well be left as long as seems necessary. They are removed through the mouth without difficulty.

Local anesthesia is employed when reduction of displacement is possible by manipulation. In cases of impaction and displacement, intratracheal anesthesia or the use of sodium pentothal may be necessary.

Associated fractures of the mandible are treated by the standard methods of direct dental fixation by wiring, arch bars or splints, with intermaxillary fixation by rubber bands or tie wires.

Three fully illustrated cases show the application of the method to various types and combinations of fractures of the maxilla, malar zygomatic compound, and the mandible.—*Surgery*, 12:523-540, October 1942.

EARLY AND LATE TREATMENT OF THE FACE AND JAWS AS APPLIED TO WAR INJURIES. Robert H. Ivy.

Continuous treatment, from first-aid in the combat zone to reconstruction in a base hospital, is necessary. The principles and details of treatment of wounds of the face and jaws sustained by combatants apply also to similar injuries suffered by civilians subjected to air raids or shellfire. The methods advocated for use by active enlisted personnel can be put in practice by civilian defense forces under like circumstances. As outlined by Dr. Ivy, the management of facial trauma is divided into first-aid, temporary care and final restoration and rehabilitation.

FIRST AID

The first-aid packet issued to officers and enlisted men of the medical department is admirably adapted for use in the immediate treatment of wounds of the face and jaw. The compress sewn to the portion can be made to serve as a sling for support of the injured structures.

If the attached bandage is torn lengthwise, the dressing becomes an ideal four-tailed bandage. The compress itself can be separated from the bandage and used as an extra packing, a dressing or a support over any region. The safetypins help to make the dressing secure and provide attachment for elastic traction by rubber bands when necessary.

Hemorrhage may be checked by digital pressure over the artery nearest the bleeding area, the principal points being: (1) the external carotid artery, with compression beneath the anterior border of the sternocleidomastoid muscle at the level of the thyroid cartilage; (2) facial or external maxillary artery, with pressure over the lower border of the mandible three-fourths inch in front of the angle, and (3) superficial temporal artery, with pressure just in front of the ear. Moderate hemorrhage from a wound about the jaw can usually be checked by pressure of a gauze pack inserted in the wound and held in place by a four-tailed bandage in such a way that respiration is not interfered with.

If pressure will not control the bleeding, the blood vessel should be clamped. If the vessel cannot be ligated immediately, the clamp should be left in place.

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PREPARATION FOR TRANSPORT

If loss of control of the tongue, because of injury to the supporting bone and muscle, makes respiration difficult, a long suture should be placed through the tip of the tongue and attached to the dressing, or the tongue should be transfixed with a large safetypin. In other cases, a rubber tube can be inserted in the naso-pharynx to assure free passage of air during transport.

If time permits and materials are available, the wound can be cleansed and loose fragments of bone extracted as an aid in emergency fixation of the fractures. Only completely detached fragments of bone or teeth should be removed, since pieces of bone with any connection with soft tissue may be viable and hence suitable for use in subsequent restoration. Fixation of lower to upper teeth should never be attempted before unattended travel. Stabilization of parts by measures which will not interfere with breathing reduces pain and danger of shock.

Wounds communicating with the lower jaw or oral cavity should not be closed without provision for dependent drainage. Crystalline sulfanilamide is applied liberally to all wounds and sulfanilamide should be administered orally according to instructions in the first-aid packet, 6 gm. at once and 1 gm. every four hours thereafter. During transport, those suffering facial injuries should be placed face downward or instructed to sit up if able.

BURNS

For the treatment of burns of the hands and face, the Conference on Burns of the National Research Council recommends the following:

First-Aid Therapy.—The hands and face are to be covered with an aqueous emulsion containing 5 per cent sulfadiazine or, if that is not available, boric ointment. These surfaces are then to be covered if possible with a fine mesh gauze (44) and a firm pressure bandage employing cotton waste should be applied to the hands. No bandages should be applied to the face.

The eyes, if treatment is necessary, should have a single instillation of a 2 per cent butyn ophthalmic ointment. The patient must be warned not to rub his eyes once this anesthetic agent has been applied, as otherwise the cornea may be severly injured.

Definitive Treatment of Burns.—Dressings are removed and the surfaces of the burn and then the surrounding skin cleansed with a mild soap and water applied with pledgets of cotton and nothing else. The burned surfaces must not be scrubbed.

After cleansing, the surface is rinsed freely with a physiologic sodium chloride solution. The blisters are opened and all necrotic epidermis is removed under the best possible aseptic precautions and with minimal trauma. The aqueous emulsion containing 5 per cent sulfadiazine or boric ointment is then generously applied to the burned area and covered with fine mesh gauze. The pressure dressing on the hands is then reapplied, but the face should not be covered. The dressing should be changed only when necessary.

In third degree burns, at the time of redressing, a light frosting of crystalline sulfanilamide should be applied. As soon as the granulating surface is reasonably clean, skin grafting should be performed.

ADVANCED CLEARING STATIONS

At advanced hospital stations, hemorrhage is permanently controlled by ligation of vessels; the wound is cleaned and thorough débridement is carried out; fragments are fixed in approximately normal position by wiring or appliances; soft parts are restored to normal relations; raw surfaces are covered; drainage is assured, and more sulfanilamide is given, locally and internally.

The problem at the base or general hospital is that of complete eradication of all infection; reduction and fixation of bone fragments; repair and restoration of lost tissue by means of flaps and grafts and by other plastic procedures, and rehabilitation by replacement of missing teeth with artificial dentures, prostheses and whatever other agencies are indicated.—*South. Surgeon,* 11:366-373, May 1942.

ONE HUNDRED AND ONE CASES OF INFECTIONS OF THE FACE AND NECK FOLLOWING ORAL PATHOLOGY. Gerald R. O'Brien and Leonard R. Rubin.

The authors report 101 cases of infections of the face and neck attributed to dental disease. The patients were admitted to Kings County Hospital, Brooklyn, during one year (1939-1940). Seventy per cent of cases occurred in the age groups from 6 to 30. In 60 per cent, the spread of infection occurred within the first week. The most serious cases followed the extraction of teeth. In the upper jaw, the central incisors and the first molars were more often involved, whereas, in the mandible, the molars were more often concerned in initiation of the infection, which spreads to produce suppurative periostitis at the side of the local lesion and extends to break through to the deeper structures. In some cases, the infection starts as a soft tissue cellulitis and extends to contiguous structures or to distant structures through the veins or lymph vessels. The importance of fascial planes of the face and neck as determining factors in the spread and localization of suppuration is stressed. The muscles serve as landmarks, whereas the fascia forms a strong wrapping material that encloses the whole of the neck in one package, with each structure or group of structures in its own separate housing. Between the layers of fascia are spaces containing connective tissue through which pass blood vessels, lymphatics and nerves, providing pathways along which pus may burrow. Knowledge of the position of these spaces containing a great amount of connective tissue enables the surgeon to explore them safely for drainage without entering danger zones. These spaces are found in (1) the floor of the mouth, (2) along the carotid sheath, (3) in the prevertebral or retropharyngeal space, (4) in the lateral pharyngeal or pharyngomaxillary space and (5) at the tip of the mastoid process. The entire anatomy of the fascial planes and spaces is given in detail. The lateral pharyngeal (pharyngomaxillary) space is involved in half of all deep neck infections. It may be infected from the pharyngeal region, from the submaxillary space and from the lower molars.

Diagnosis and treatment are discussed in detail. The average submaxillary infections localize and fluctuate, and when there is little toxicity, one can wait for fluctuation while employing hot compresses locally and routine sulfanilamide therapy. When the temperature remains high with no fluctuation

manifest, immediate surgical intervention is indicated, since the spread has been inward to the parapharyngeal (lateral pharyngeal) space. The skin is incised, after which the deeper spaces are carefully explored by blunt dissection with a curved clamp.

The authors do not agree with the conservative handling of the woody phlegmon, concluding from their anatomic studies that watchful waiting may mean a dead patient. They prefer an incision from one submaxillary space through the submental region to the opposite submaxillary space. Rubber tubes are inserted to the spaces and sewn in position for drainage and postoperative irrigation. Local anesthesia is used for incision and drainage.

Tracheotomy may be necessary in case of difficulty in breathing and should be performed early.

In conclusion, the authors state that forty-one patients recovered with conservative treatment, intra-oral spontaneous drainage occurring in twenty-three of these. Twenty-six patients required intra-oral incisions. Thirty-four external incisions were necessary. Twenty-seven of these involved the submaxillary space, and twenty of the twenty-seven extended to involve the lateral pharyngeal space. Five cases of Ludwig's angina from the lower molar infections were treated, two with a history of tooth extraction and curettage of the socket one day later. The symptoms developed within twenty-four hours.

Two patients had an infection of the temporal space. In this series of infections of dental origin, no retropharyngeal involvement was seen. A brief outline of surgical treatment includes mouth hygiene, sulfonamide therapy, intravenous medication, transfusion, nasal feeding if necessary, early incision and drainage, with rubber tube postoperative drainage and irrigation of the external carotid artery or internal jugular vein for severe hemorrhage.—*Am. J. Surg.*, 55:102-112, January 1942.

WILLIAM HOFFMAN GARDINER LOGAN, D.D.S., M.D., LL.D., M.S.
(1872-1943)

As we go to press, word is received of the sudden death of William H. G. Logan, oral surgeon, of Chicago, April 6. Dr. Logan was dean and professor of oral surgery of Chicago College of Dental Surgery, Dental College of Loyola University. He was the President of the American Dental Association for the year 1917-1918 and president of the International Dental Federation 1936-1941. Among the associations in which he held membership were the American Association of Dental Schools, the American College of Surgeons, (member of the board of governors), American Association of Oral and Plastic Surgeons (founder), Gorgas Memorial Institute of Tropical and Preventive Medicine (secretary) and the Delta Sigma Delta fraternity. Dr. Logan was a major in the Medical Reserve Corps in 1917 and chief of the dental division, Surgeon General's Office. He rose to the rank of colonel in 1918 and was honorably discharged in February 1919. He was widely known for his writings on cleft palate and cleft lip. A daughter, Mrs. Donald L. La Chance (Jean Brophy Logan) survives.

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